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Attorneys for Defendant Viad Corp. f/k/a The Dial Corporation

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF UTAH, CENTRAL DIVISION

HOWARD WADE AND DEANNA LYNN WADE, Plaintiffs, v. INDUSTRIAL SUPPLY COMPANY, INC. et al., Defendants.	**DECLARATION OF REBECCA L. HILL IN SUPPORT OF DEFENDANT VIAD CORP.'S NOTICE OF REMOVAL PURSUANT TO 28 U.S.C. § 1442** Case No. ____________

Pursuant to 28 U.S.C. § 1746, I, Rebecca L. Hill, states as follows:

1. I am a resident of Salt Lake City, Utah and I am over eighteen years of age.

2. I am counsel of record representing Defendant Viad Corp. *f/k/a* The Dial Corporation ("Viad") sued erroneously herein as successor-in-interest to Griscom Russell Co. ("Griscom-Russell") in the above-captioned suit. As counsel, I have personal knowledge of all of the matters set forth herein, except as to those matters stated upon information belief, which I in good faith believe to be true.

3. Attached hereto as Exhibit A is a true copy of the Summons and Original Complaint

and Jury Demanded ("Complaint") in the matter of Howard Dean et al. v. Industrial Supply Company et al., filed in the Third Judicial District Court, in and for Salt Lake County, State of Utah on December 29, 2021, Case No. 210907011.

4. Attached hereto as Exhibit B is a true copy of the Declaration of Charles R. Cushing, Ph.D., P.E.

5. Attached hereto as Exhibit C is a true copy of the Declaration of Rear Admiral Ben J. Lehman, U.S. Navy, Ret., including attachments and affidavits thereto, that was submitted in the action styled *Genevieve Schroeder et al. v. A.W. Chesterton, et al.*, United States District Court for the Central District of California (Civil Docket No.: CV11-00738 (VBK).

6. Attached hereto as Exhibit D is true copy of the slip opinion issued in *Reaser v. Allis Chambers Corp.*, CV 08-1296-SVW (SSx (C.D. Cal. June 23, 2008).

7. Attached hereto as Exhibit E is a true copy of the Notice of Filing of Notice of Removal which I caused to be, or will cause to be, timely filed in the Third Judicial District Court in and for Salt Lake County, State of Utah.

DATED 14th day of February, 2022.

Rebecca L. Hill

Rebecca L. Hill
Attorney for Defendant Viad Corp. *f/k/a*
The Dial Corporation

CT Corporation

Service of Process Transmittal

01/13/2022
CT Log Number 540879436

TO: Jennie Kaleta
VIAD CORP
7000 E 1ST AVE
SCOTTSDALE, AZ 85251-4304

RE: **Process Served in Utah**

FOR: Viad Corp (Domestic State: DE)

ENCLOSED ARE COPIES OF LEGAL PROCESS RECEIVED BY THE STATUTORY AGENT OF THE ABOVE COMPANY AS FOLLOWS:

TITLE OF ACTION: Re: HOWARD WADE and DEANA LYN WADE // To: Viad Corp

DOCUMENT(S) SERVED: --

COURT/AGENCY: None Specified
Case # 210907011

NATURE OF ACTION: Asbestos Litigation - Personal Injury

ON WHOM PROCESS WAS SERVED: C T Corporation System, Midvale, UT

DATE AND HOUR OF SERVICE: By Certified Mail on 01/13/2022 postmarked: "Not Post Marked"

JURISDICTION SERVED : Utah

APPEARANCE OR ANSWER DUE: None Specified

ATTORNEY(S) / SENDER(S): None Specified

ACTION ITEMS: CT has retained the current log, Retain Date: 01/13/2022, Expected Purge Date: 01/18/2022

Image SOP

Email Notification, Jonathan Massimino jmassimino@viad.com

Email Notification, Jennie Kaleta jkaleta@ges.com

Email Notification, Lynne Kelly lkelly@viad.com

Email Notification, Kaitlyn Fleming kfleming@ges.com

Email Notification, Carolyn Whyte cwhyte@viad.com

REGISTERED AGENT ADDRESS: C T Corporation System
1108 E. South Union Avenue
Midvale, UT 84047

866-665-5799
SouthTeam2@wolterskluwer.com

The information contained in this Transmittal is provided by CT for quick reference only. It does not constitute a legal opinion, and should not otherwise be relied on, as to the nature of action, the amount of damages, the answer date, or any other information contained in the included documents. The recipient(s) of this form is responsible for reviewing and interpreting the included documents and taking appropriate action, including consulting with its legal and other

CT Corporation

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advisors as necessary. CT disclaims all liability for the information contained in this form, including for any omissions or inaccuracies that may be contained therein.

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NLF NEMEROFF LAW FIRM
NATIONAL TRIAL LAWYERS
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VIAD CORP. f/k/a the DIAL CORPORATION,
individually and as successor in
interest to GRISCOMB-RUSSELL COMPANY
c/o CT Corporation System
1108 East South Union Avenue
Midvale, UT 84047

Richard I. Nemeroff, #13966
THE NEMEROFF LAW FIRM
A PROFESSIONAL CORPORATION
5532 Lillehammer Lane, Suite 100
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Attorneys for Plaintiffs

IN THE THIRD JUDICIAL DISTRICT COURT

IN AND FOR SALT LAKE COUNTY, STATE OF UTAH

HOWARD WADE AND DEANA LYNN WADE, Plaintiffs, v. INDUSTRIAL SUPPLY COMPANY, INC., et al., Defendants.	***SUMMONS*** Case No. 210907011 Judge Randall Skanchy

THE STATE OF UTAH TO DEFENDANT:

VIAD CORP. f/k/a the DIAL CORPORATION, individually and as successor in interest to GRISCOMB-RUSSELL COMPANY
c/o CT Corporation System
1108 East South Union Avenue
Midvale, UT 84047

You are hereby summoned and required to file an answer in writing to the attached Complaint with the clerk of the above-entitled Court at 450 South State Street, Salt Lake City, Utah 84101, and to serve upon or mail to Plaintiffs' attorney, Richard I. Nemeroff, The Nemeroff Law Firm, 3355 West Alabama Street, Suite 650, Houston, Texas 77098, a copy of said answer, pursuant to §1 Paragraph 4 of *In Re: Asbestos Litigation Case Management Order No. 1* within forty five (45) days after service of this Summons upon you.

If you fail to do so, judgment by default will be taken against you for the relief demanded in said Complaint, which has been filed with the clerk of said Court and a copy of which is hereby annexed and herewith served upon you.

I declare under criminal penalty under the law of Utah that everything stated in this document is true.

DATED this 6th day of January 2022.

THE NEMEROFF LAW FIRM
A PROFESSIONAL CORPORATION

Richard I. Nemeroff, Esquire
Attorney for the Plaintiffs

Richard I. Nemeroff, #13966
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Attorneys for Plaintiffs

IN THE THIRD JUDICIAL DISTRICT COURT

IN AND FOR SALT LAKE COUNTY, STATE OF UTAH

HOWARD WADE and DEANA LYN WADE, Plaintiffs, v. INDUSTRIAL SUPPLY COMPANY, INC., et al. Defendants,	ORIGINAL COMPLAINT AND JURY DEMANDED Case No. 210907011 Judge Randall Skanchy

CIVIL ACTION COMPLAINT

PLAINTIFFS, Howard Wade and Deana Lyn Wade, his wife, by and through their attorneys, the Nemeroff Law Firm, A Professional Corporation, hereby bring this Civil Action Complaint, whereof the following is a statement:

JURISDICTION AND VENUE

1. This Court has personal jurisdiction over the Defendants because the Defendants are duly licensed to do business in the State of Utah and/or at all material times are or have been engaged in business in the State of Utah.

2. Each defendant identified on Exhibit A is amenable to suit in the State of Utah by reason of having sold, distributed, and/or installed the aforementioned asbestos-containing products in Utah or by reason of having placed the same into the stream of commerce for use in Utah, and by reason of having committed tortious acts against the Plaintiff in this state in addition to Defendants other general construction product business sales.

3. Venue is proper in Salt Lake County, Utah in that one or more Defendants maintain its principal office or principal place of business in Salt Lake County under Section 78-13-7, U.C.A., 1953.

BACKGROUND

4. Plaintiffs, Howard Wade and Deana Lyn Wade, his wife, (hereinafter "Plaintiffs), are citizens and residents of Washington County in the State of Utah.

5. Plaintiffs bring this action for monetary damages as a result of Plaintiff, Howard Wade, contracting an incurable asbestos cancer that Mr. Wade was diagnosed with as a result of breathing asbestos dust. Plaintiff Howard Wade was diagnosed with Malignant Mesothelioma, a signal tumor for exposure to asbestos, on or about October 5, 2021.

6. Mr. Wade was exposed to asbestos through his work with and around asbestos-containing products while working at the following locations:

1964-1968: St. George Wastewater Treatment plant; St. George, UT

11/1968-08/1973: US Navy –San Diego, CA; Great Lakes, IL; Long Beach, CA

1977-1989: St. George Waste Water Plant; St. George, UT

The activities of cutting, chipping, mixing, sanding, sawing, scraping, grinding, and sweeping of asbestos-containing products that occurred in association with the work performed by Mr. Wade and other workers working around Mr. Wade with asbestos-containing products exposed him to great quantities of asbestos. These asbestos exposures continued as asbestos-containing dust accumulated on his work clothes and was transported to his cars and home.

7. Asbestos dust released from construction and commercial and/or industrial equipment related work activities is generally invisible to the naked eye. During the time period that Mr. Wade was exposed to asbestos, the manufacturers of asbestos products prohibited warnings of the lethal hazards of breathing asbestos dust, often affirmatively choosing not to issue a warning at all, despite the fact that these asbestos companies knew that breathing asbestos dust could be fatal. When the asbestos dust is breathed in, it can cause asbestos cancer decades later. The scientific and regulatory communities around the world are in unanimous agreement that all types of asbestos released from asbestos products, including chrysotile asbestos, cause cancer, and that there is no safe level of exposure to asbestos.

8. Each of the Defendants knew or should have known through industry, epidemiological, and medical studies, the existence of which were unknown to Plaintiffs, of the health hazards inherent in the asbestos-containing products they were specifying, using, selling, supplying, and/or manufacturing.

9. All of the named defendants listed on the attached list, which is incorporated by reference herein, are amenable to jurisdiction in the courts of Utah by virtue of their respective

conduct of substantial and/or systematic business in Utah which subjects them to the jurisdiction of the Utah courts pursuant to the Utah Long-Arm Statute. Each defendant corporation does or in the past mined, manufactured, processed, imported, converted, compounded, supplied, installed, replaced, repaired, used, and/or retailed substantial amounts of asbestos and/or asbestos-containing products, materials, or equipment, which are or in the past were sold, distributed, and used in Utah.

CAUSES OF ACTION

10. Plaintiffs incorporate by reference the preceding paragraphs as if fully set forth herein.

11. At all material times, Defendants are or were miners, manufacturers, distributors, processors, importers, converters, compounders, and/or retailers of asbestos and/or asbestos-containing products, materials or equipment.

12. Each of the Defendants named in Exhibit A conducted business in the State of Utah, has produced, manufactured or distributed asbestos and/or asbestos products with the reasonable expectation that such products were so used or consumed, and/or has committed the tortuous acts set forth below.

13. The Defendants, acting through their agents, servants, and/or employees caused, and have caused in the past, certain asbestos and asbestos-containing materials, products or equipment to be placed in the stream of commerce with the result that said asbestos and asbestos-containing materials, products or equipment came into use by the Plaintiff.

14. The dangers of breathing asbestos were first published in the medical literature in the 1890s. By the late 1950s, there were hundreds of medical articles highlighting the dangers of being around asbestos dust. Confidential corporate documents from the named defendant

companies reveal that (a) the dangers of asbestos were well understood; (b) asbestos was cheaper to use in the products than replacement substances such as clay; (c) the product manufacturing industry actively fought governmental regulation and the banning of asbestos. To this day industry has been successful in their lobbying efforts to keep asbestos legal in the United States.

15. Throughout the course of his employment, Plaintiff worked with and/or was exposed to the asbestos and asbestos-containing materials, products or equipment mined, manufactured, processed, imported, converted, distributed, compounded, and/or sold by the Defendants. Investigation is ongoing, but upon information and belief, most of Plaintiff's exposure to asbestos occurred within the state of Utah.

16. During the course and scope of his employment, Plaintiff was exposed to Defendants' asbestos and asbestos-containing materials, products or equipment, which exposure directly and proximately caused him to develop an illness known and designated as Mesothelioma.

17. Defendants, acting by and through its servants, agents and employees, duly authorized and acting within the scope and authority of their employment, had a duty to use, specify, design, manufacture and sell products that were not unreasonably dangerous or defective and/or a duty to warn the Plaintiff and foreseeable users of said products of the dangers and defects which the Defendants created, knew, or, within the exercise of reasonable care, should have known. Defendants knew or should have known that these asbestos-containing materials would be used or handled by Plaintiff and others working in close proximity to him in a way that resulted in the release of airborne asbestos fibers, and that without the exercise of reasonable care in establishing and enforcing safe work practices, Plaintiff would be exposed to these asbestos fibers.

18. Plaintiff, worked with and around asbestos and/or asbestos-containing products,

materials or equipment that were manufactured, processed, distributed, supplied and/or sold by Defendants during his employment at various locations identified in paragraph 6. Defendants knew or should have known that persons in the position of Plaintiff would come into contact with and would work in close proximity to said products.

19. Plaintiffs sustained injuries caused by no fault of their own and which could not be avoided through the use of his reasonable care largely because Defendants affirmatively chose not to warn of asbestos dangers or advise of safe work practices. Plaintiff's development of an asbestos-related disease was directly and proximately caused by the negligence and carelessness of Defendants in that they manufactured, processed, sold, supplied or otherwise put said asbestos or asbestos-containing products, materials or equipment, into the market and into the stream of commerce, while they knew, or in the exercise of ordinary care should have known, that said products were deleterious, poisonous, cancer-causing and/or inherently dangerous and harmful to Plaintiff's body, lungs, respiratory system, skin, health, and general well-being. Further, defendants knew or in the exercise of reasonable care should have known that Plaintiff would not know of such danger to his health.

20. Plaintiff's illness and disability are the direct and proximate result of the negligence and carelessness of defendants, in that, the defendants knew, or in the exercise of ordinary care should have known, that the asbestos and asbestos-containing materials, products or equipment were deleterious, poisonous, and highly harmful to Plaintiff's body, lungs, respiratory system, skin, and health.

21. The actions of the defendants described and alleged above were wrongful under Utah Products Liability Act in one or more of the following ways:

(a) Said asbestos-containing products were unreasonably defective in one or more of the following ways:

1. in that said products were and are unavoidably unsafe, and defendants affirmatively chose how to warn, selecting to carry improper, inadequate and incorrect warnings about their asbestos dust hazards about which the defendants knew or should have known;

2. in that said products were and are unreasonably dangerous, in that they were and are dangerous to an extent beyond that which the ordinary worker or bystander in the position of the plaintiff would contemplate;

3. in that any warnings, information and/or safety instruction said products may have carried, were improper and inadequate in that they affirmatively determined the information told users and/or others, including the plaintiff, leading to inadequate and unreasonable communication of the hazards and dangers of coming in contact with said products, including the risk of cancer and death.

(b) The defendants knew or should have known that said asbestos-containing products were inherently dangerous to those who used them, yet the defendants affirmatively chose not to use reasonable and/or ordinary care in seeing to it that said products carried proper, adequate and correct warnings of the dangers of said products, and the exposure of the plaintiff and others like the plaintiff to these products was reasonably foreseeable to the defendants;

(c) The defendants breached warranties, either implied or expressed, in that these products were not fit and/or safe for their known and intended purposes and uses.

1. The Defendants impliedly warranted that said asbestos materials were of good and merchantable quality, safe, and fit for their intended use.

2. The implied warranty made by the Defendants that the asbestos and asbestos-containing materials, products, or equipment were of good and merchantable quality and for the particular intended use was breached and that certain harmful, poisonous, and deleterious matter was given off into the atmosphere wherein the plaintiff carried out his duties while working with or in the vicinity of asbestos and asbestos-containing materials, products, or equipment.

3. As a direct and proximate result of the implied warranty of good and merchantable quality and fitness for the particular intended use, plaintiff developed an illness, to-wit: Malignant Mesothelioma.

22. Defendants, at the time of designing, manufacturing, distributing, selling, or otherwise placing asbestos and/or asbestos-containing products, materials or equipment into the stream of commerce, knew, or in the exercise of reasonable care, should have known about the insurable risks associated with their products. The products in question were defective at the time they left the control of the Defendants.

23. Defendants were negligent and breached their duty of due care to Plaintiff by taking the affirmative actions as previously alleged to avoid harm to the Plaintiff and other foreseeable users, in light of the reasonably foreseeable and insurable dangers caused by the design, manufacture, sale, distribution of the asbestos and/or asbestos-containing products, materials or equipment at issue in the stream of commerce.

24. The hazards posed by exposure to asbestos and/or asbestos-containing products, materials or equipment and the resulting injuries and damages to Plaintiff were reasonably foreseeable, or should have been reasonably foreseen by Defendants.

25. As a direct and proximate result of the aforesaid negligent acts and/or omissions by the Defendants, Plaintiff Howard Wade developed Malignant Mesothelioma, as a consequence of which, through no fault of his own, he is severely injured, disabled and damaged.

26. During, before, and after Plaintiff's exposure to asbestos products manufactured, installed or otherwise used by Defendants, the Defendants falsely represented facts, including the dangers of asbestos exposure, to Plaintiff in the particulars alleged in the paragraphs above, while Defendants each had actual knowledge of said dangers of asbestos exposure to persons such as Plaintiff, and while Defendants each knew of the falsity of their representations and/or made the representations in reckless disregard of their truth or falsity.

27. The foregoing affirmative representations were material conditions precedent to Plaintiff's continued exposure to asbestos-containing products, and defendants each intended that Plaintiff act upon the representations by continuing his exposure to the asbestos products. Plaintiff was ignorant of the falsity of Defendants' representations and rightfully relied upon the representations.

28. As a direct and proximate result of Plaintiff's reliance upon Defendants' false representations, plaintiff has suffered injury and damages hereinafter described.

29. The Defendants were all miners, manufacturers, assemblers, sellers, users, distributors and/or suppliers of asbestos products and were engaged in the business of using, manufacturing or facilitating the manufacture of asbestos products, or representing themselves as manufacturers of asbestos products, or were professional vendors of asbestos or asbestos-containing products, which were expected to and did reach, including but not limited to, each of the locations where Mr. Wade was exposed.

30. At all times material hereto, the Defendants knew or should have known of the harmful effects and/or harmful dangers of working with asbestos and/or asbestos-containing products, materials, or equipment and exposures to inhalable asbestos.

31. Defendants had a duty to warn individuals working at the Plaintiff's jobsites, including but not limited to Plaintiff, of the dangers associated with the use and/or inhalation of asbestos dust and fibers.

32. Despite Defendants' knowledge of the insurable harm and/or potential harm associated with the use and/or inhalation of dust and fibers from asbestos and/or asbestos-containing products, materials, or equipment, the Defendants affirmatively chose the level of

warning by either not warning and/or inadequately warning Plaintiff of the dangers of asbestos and asbestos dust.

33. The products mined, manufactured, sold, distributed, supplied and/or used by these defendants were defective, unreasonably dangerous, insurable and unreasonably dangerous per se, to Plaintiff who was an intended and foreseeable user and bystander who was exposed to these products. These defects include, without limitation, the following:

(a) The mining, manufacture, assemble, sale, supply, distribution and use of products that are unreasonably dangerous, or unreasonably dangerous per se;

(b) The mining, manufacture, sale, supply, distribution and use of products that possess inherent and known properties that make them unreasonably dangerous by presenting high potential for causing serious injury, such as respiratory disease, cancer, and other health problems to the Plaintiff who would be foreseeably exposed to them in as a result of their intended use;

(c) The affirmative act of not warning or insufficiently warning of the hazards these products would present in the course of their normal foreseeable use or intended use;

(d) Providing inadequate cautions, warnings, and/or hazard statements and/or explanations with its products which should have been designed to provide to the Plaintiff knowledge about the hazards caused by exposure to their products and how to eliminate such hazards;

(e) Providing inadequate product inserts, informative brochures, employee training literature, posters, safety instructions and/or other written materials with their products which should have been designed to provide to the Plaintiff knowledge about the hazards caused by exposure to its products and how to eliminate such hazards;

(f) Conducting inadequate on-site personnel training sessions with exposed workers which should have been designed to provide to the workers' knowledge about the hazards caused by exposure to the products, and how to eliminate the hazards;

(g) Inadequately testing and researching their products as to the hazards created during their use and providing incomplete results of such tests and research to the intended or foreseeable users of exposed individuals such as Plaintiff;

(h) Inadequately inspecting workplaces in which their products were being used to determine whether the products being used were deleterious to the health of exposed workers or individuals;

(i) Inadequately inspecting their products to assure sufficiency and adequacy of warnings and safety cautions;

(j) Inadequately designing, processing and transporting their products in a manner intended to minimize exposure during normal working conditions;

(k) Inadequately designing their products when the nature of the product did not require use of asbestos mineral or where alternate, equally suitable substances were readily available;

(l) Defects in the composition and construction of these products;

(m) Affirmatively specifying and marketing their products without the express agreement that necessary engineering controls, work practices, and other industrial hygiene controls would be implemented in conjunction with use of the products after it was known or should have been known that adequate protective measures were not being implemented;

(n) Issuing inadequate recalls of their defective product or manufacturing a reasonably safer alternative;

(o) Inadequately packaging their products so that they could be safely transported, handled, stored or disposed of;

(p) Implementing inadequate precautions and industrial hygiene measures to protect Plaintiff and exposed workers when installing, repairing, or tearing out asbestos and/or asbestos-containing products, materials, or equipment including, but not limited to, providing protection from dust and fibers emanating from the installation, repair, and/or removal process; using or implementing inadequate local ventilation, warnings, cleaning procedures and other appropriate safety and industrial hygiene measures;

(q) Affirmatively acting unreasonably under the totality of the circumstances.

34. Defendants manufactured, processed and/or sold asbestos and/or asbestos-containing products and materials, and these products were used by Plaintiff and others working around Plaintiff at Plaintiff's worksites. It was foreseeable that Plaintiff would be exposed to these asbestos-containing products and materials manufactured, processed, sold, specified and/or used

by Defendants. Thus, Defendants had a duty to warn individuals, including but not limited to the Plaintiff, of the dangers associated with the use and/or inhalation of dust and fibers from asbestos and/or asbestos-containing products, materials, or equipment.

35. Despite Defendants' knowledge of the insurable harm and/or potential harm associated with the use and/or inhalation of dust and fibers from asbestos and/or asbestos-containing products, materials, or equipment, the Defendants acted unreasonably in providing inadequate warnings and/or instructions as to the hazards associated with exposure to asbestos and/or asbestos-containing products, materials, or equipment.

36. At the time the asbestos and/or asbestos-containing products, materials, or equipment left Defendants' control without adequate warning or instruction, Defendants created an unreasonably dangerous condition that it knew or should have known would pose a substantial risk of harm to a reasonably foreseeable claimant, such as the Plaintiff. In the alternative, after the asbestos-containing products left Defendants' control, Defendant became aware of or in the exercise of ordinary care should have known that their product posed a substantial risk of harm to a reasonably foreseeable user or bystander, such as the Plaintiff, and failed to take reasonable steps to give adequate warning or instruction or to take any other reasonable action under the circumstances.

37. It was the continuing duty of the defendants to advise and warn purchasers, consumers, and users, and all prior purchasers, consumers, and users, of all dangers, characteristics, potentialities and/or defects discovered subsequent to their initial marketing or sale of said asbestos and asbestos products.

38. The defendants breached these duties by:

(a) Choosing to inadequately warn the plaintiff of the dangers, characteristics, and/or potentialities of the product or products when they knew or should have known that the exposure to the product(s) would cause disease and injury;

(b) Choosing not to warn the plaintiff of the dangers to which the plaintiff was exposed when they knew or should have known of the dangers;

(c) Exercising unreasonable care to warn the plaintiff of what would be safe, sufficient, and properly protective clothing, equipment, and appliances when working with, near or during exposure to asbestos and asbestos products;

(d) supplying asbestos or asbestos products that were packaged, bagged, boxed and/or supplied to the plaintiff in packaging, bagging, boxes or other containers that were inadequate and/or improper;

(e) supplying asbestos or asbestos products that were delivered to and reached the plaintiff without adequate or proper handling instructions, face masks and/or respirators;

(f) Choosing to inadequately test or choosing not to test the asbestos and asbestos products in order to ascertain the extent of dangers involved upon exposure;

(g) Conducting inadequate research or exercising reasonable care in order to ascertain the dangers involved upon exposure;

(h) Choosing not to remove the product or products from the market when the defendant corporations knew or should have known of the hazards of exposure to asbestos and asbestos products;

(i) Once the dangers, hazards, and potentialities of exposure to asbestos were discovered, choosing not to adequately to warn and apprise plaintiff of the dangers, hazards, and potentialities discovered;

(j) generally using unreasonable, careless, and negligent conduct in the contracting for, mining, milling processing, manufacturing, designing, testing, assembling, fashioning, fabricating, packaging, supplying, distributing, delivering, marketing, and/or selling of their asbestos and asbestos products.

39. Defendants affirmatively chose not provide adequate warnings as to the hazards associated with exposure to asbestos and/or asbestos-containing products, materials, or equipment or to provide proper instructions on the use, handling, and storage of asbestos and/or asbestos-

containing products, materials, or equipment. Defendants' affirmative acts caused Mr. Wade to develop Malignant Mesothelioma as a consequence of which Plaintiffs have been injured and damaged and claims damages of the Defendants in negligence and strict liability.

40. The defective conditions of Defendants' products and fault, as noted above, are a proximate cause of Plaintiff's injuries complained of herein.

41. As a result of the Defendants' failure to warn, the Plaintiffs suffered and will continue to suffer the following injuries and damages hereinafter alleged.

42. Plaintiff and others in his position worked in close proximity to the asbestos and asbestos-related materials used or manufactured by the Defendants, and the exposure and hazard to each of them, in Plaintiff's presence, as well as others in his position, was known, or in the exercise of reasonable care should have been anticipated by the Defendants.

43. The Defendants have known or should have known since at least 1929, and possibly as early as 1890, of medical and scientific data which clearly indicates that asbestos and asbestos-containing products were hazardous to the health and safety of the Plaintiff and others in the Plaintiff's position. Prompted by pecuniary motives, the Defendants, individually and collectively, ignored and chose not to act upon said medical and scientific data and conspired to deprive the public, and particularly the users, of said medical and scientific data, depriving them, therefore, of the opportunity of free choice as to whether or not to expose themselves to the asbestos products of said defendants. As a result, the Plaintiff has been severely damaged as is set forth below.

44. The Defendants fraudulently misrepresented or chose not to disclose the dangers of asbestos exposure from 1929 through the 1980s, thus denying Plaintiff the knowledge with which to take necessary safety precautions such as periodic x-rays and medical examinations and

avoiding further dust exposure. Specifically, Defendants' affirmative and fraudulent conduct included the following acts and failures to act:

(a) Inadequately warning prior users when the Defendants had knowledge of the need for monitoring due to prior exposure;

(b) Choosing not to issue recall type letters to prior users;

(c) frustrating the publication of articles and literature from the 1930s through at least 1979;

(d) rejection by top management of advice of corporate officials to warn of the hazards of their asbestos products; such rejection being motivated by the possibility of adverse effects on sales and profits; and

(e) The intentional inadequacy of (and delay in the use of) the warnings on asbestos products.

45. The acts of the Defendants, and each of them, as hereinabove set forth were fraudulent and done with willful disregard of the safety of Plaintiff and others similarly situated at a time when Defendants, had knowledge, or should have had knowledge of the dangerous effect of asbestos and asbestos-containing materials, products or equipment upon the body of human beings, including Plaintiff and others similarly situated, and even though forewarned by tests, standards, promulgations of rules and regulations, statutes, and ordinances recognized by the Defendants and subscribed to by them, nevertheless placed into the stream of commerce, for their own profit, this dangerous asbestos material with full knowledge that it was being used and would be used in the future to the detriment of the health of Plaintiff and others similarly situated, and Plaintiff is thereby entitled to punitive damages.

46. The affirmative acts of Defendants constituted fraudulent misrepresentation in that a false representation was made as a statement of fact, the statement was untrue and known to be

so by its maker, the statement was made with the intent of inducing a reliance thereon, and the Plaintiff relied on the statement to his detriment. In the alternative, the affirmative acts of Defendants constituted fraudulent non-disclosure in that Defendants intentionally withheld information to induce individuals such as Plaintiff to continue to purchase or use their asbestos containing products. Defendants hid known facts with the intent or expectation to cause a mistake by another to exist or to continue, or in order to induce the latter to enter into a transaction.

47. Accordingly, as a result of the Defendants' conduct in which they acted in willful, wanton, gross negligence and in total disregard for the health and safety of the user or consumer, such as Plaintiff, Plaintiffs therefore seek exemplary and punitive damages against Defendants to punish the defendants for their actions, which were willful, wanton, gross, and in total disregard of the health and safety of the users and consumers of their products.

LOSS OF CONSORTIUM

48. Plaintiffs incorporate by reference all other relevant allegations in this complaint.

49. Plaintiff Deana Lyn Wade is, and at all times since February 1, 1974, has been the lawful spouse of Plaintiff Howard Wade. At the time that Howard Wade was diagnosed with mesothelioma, Deana Lyn Wade was cohabitating with Howard Wade and enjoying his companionship and care.

50. As a direct and proximate result of the conduct described in the above allegations of this Complaint, Plaintiff Deana Lyn Wade has suffered, and will suffer, loss of consortium and damage to the marital and social relationship including, but not limited to, the loss of Howard Wade's services, comfort, affection, and the effects of Howard Wade's disease upon Plaintiff

Deana Lyn Wade and their relationship and daily activities, due to his injuries and disabilities. They have further incurred expenses for medical attention rendered to Howard Wade and will continue to incur such expenses.

51. WHEREFORE, Plaintiffs demand compensatory damages and trial by jury on all issues so triable in this cause.

PUNITIVE DAMAGES

52. Plaintiffs incorporate by reference the preceding paragraphs as if fully set forth herein.

53. As a result of the willful, wanton and gross misconduct and gross negligence of the Defendants as alleged herein, the Plaintiffs seek and request punitive or exemplary damages. Defendants malicious and outrageous disregard for the safety of users of asbestos products, including but not limited to their intentional concealment of the dangers of asbestos that they knew. Their conscious refusal to warn users of those dangers evidences a conscious indifference to the safety and health of users and bystanders of the products they profited from selling. Defendants' internal documents reveal that they knew of the hazards of asbestos by at least the mid-1960s, yet Defendants concealed the hazards of asbestos from consumers and bystanders to maintain their bottom line. Plaintiffs' injuries are the result of Defendants willful and malicious or intentionally fraudulent conduct, or conduct that manifests a knowing and reckless indifference toward, and a disregard of, the rights of others. Defendants knew that a high degree of probability existed that Defendants' conduct would result in substantial harm, that Defendants' conduct is highly unreasonable or an extreme departure from ordinary care and that a high degree of danger was apparent due to Defendants' actions. Plaintiffs, therefore, for the sake of example and by way of punishing Defendants, seek punitive damages, according to proof. Defendants' acts and omissions constitute misconduct that is grossly negligent, willful, wanton, malicious and/or outrageous.

54. As a result of the willful, wanton and gross misconduct and gross negligence of the Defendants as alleged herein, the Plaintiffs seek and request statutory punitive damages and reasonable attorney's fees.

DAMAGES

55. Plaintiffs incorporate by reference the preceding paragraphs as if fully set for herein.

56 As a result of the development of asbestos related diseases, Plaintiff has suffered and sustained very serious injuries to his person, to wit: Malignant Mesothelioma, a terminal asbestos cancer.

57 Plaintiff has further suffered and will suffer great pain, disfigurement, physical impairment, extreme nervousness, and mental anguish as a direct result of the aforesaid injuries.

58. Plaintiffs verily believe that Howard Wade's injuries and illnesses are recurrent in nature and that he will be forced to suffer same for the remainder of his life; that his enjoyment of life has been greatly impaired; that he has suffered substantial lost wages and loss of earning capacity; and further, that his expected life span has been greatly shortened.

59. Plaintiffs allege that as a result of the aforesaid illnesses, they have been forced to incur large amounts of medical expenses by way of doctor and drug bills and verily believes that they will be forced to incur additional expenses in an effort to treat Mr. Wade's illnesses as aforesaid alleged.

60. Plaintiffs require or will require domestic help and nursing care due to his disabilities and have been or will be required to pay for such domestic help and nursing services.

61. Prior to the onset of his symptoms, Plaintiff was extremely active and participated in numerous hobbies and activities, and as a result of his illnesses, Plaintiff has been and will be prevented from engaging in some of said activities that were normal to him prior to developing

symptoms from asbestos-related lung disease. Plaintiff has been and will otherwise be prevented from participating in and enjoying the benefits of a full and complete life.

WHEREFORE, the Plaintiffs verily believe they are entitled to actual damages against the Defendants by reason of said negligence, strict liability, gross negligence, breach of warranty, fraudulent misrepresentation, fraudulent non-disclosure, failure to warn and other breaches of duty as alleged herein proximately caused by the fault of the Defendants, and claim lost wages, special damages, punitive and exemplary damages, including attorney's fees, statutory punitive damages and reasonable attorney's fees.

WHEREFORE, the Plaintiffs pray for judgment against all Defendants for actual damages, lost wages, special damages, punitive and exemplary damages, including attorney's fees, statutory and punitive damages and reasonable attorney's fees, in amounts to be determined by statute or by the trier of fact, plus the costs of this action.

PLAINTIFFS REQUEST TRIAL BY JURY ON ALL ISSUES SO TRIABLE.

THE NEMEROFF LAW FIRM

/s/ Richard I. Nemeroff

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5532 Lillehammer Lane, Ste. 100
Park City, UT 84098
Tel: 435-602-4470
Fax: 435-602-4471
E-mail: ricknemeroff@nemerofflaw.com

Attorney for Plaintiffs

EXHIBIT A

DEFENDANT SERVICE LIST

INDUSTRIAL SUPPLY COMPANY, INC.
c/o Chris Bateman
1635 S 300 W
Salt Lake City, UT 84115

AIR & LIQUID SYSTEMS CORPORATION AS SUCCESSOR BY MERGER TO BUFFALO PUMPS, INC
Air & Liquid Systems Corp., as successor by merger to Buffalo Pumps, Inc.
874 Oliver Street
North Tonawanda, NY 14120-3298

ALDER CONSTRUCTION COMPANY
c/o Bruce C. Alder
3939 S 500 W
Salt Lake City, UT 84123

AMERON INTERNATIONAL CORPORATION
c/o CT Corporation System
1108 E. South Union Ave.
Midvale, UT 84047

ARMSTRONG INTERNATIONAL, INC.
900 Maple Street
Three Rivers, MI 49093

AURORA PUMP COMPANY
c/o Corporation Service Company
15 West South Temple, Suite 600
Salt Lake City, UT 84101

BLAKE ELECTRIC CO.
c/o Teddy Jay Lewis
625 South 1000 West
Richfield, UT 84701

BW/IP, INC.
5215 N. O'Conner Boulevard, Suite 2300
Irving, TX 75039

CARRIER CORPORATION INDIVIDUALLY AND AS SUCCESSOR-IN-INTEREST TO BRYANT HEATING & COOLING SYSTEMS
c/o United Agent Group, Inc.
2825 East Cottonwood Parkway, #500
Salt Lake City, UT 84121

CBS CORPORATION, A DELAWARE CORPORATION F/K/A VIACOM INC. SUCCESSOR-BY-MERGER TO CBS CORPORATION, A PENNSYLVANIA CORPORATION F/K/A WESTINGHOUSE ELECTRIC CORPORATION
Westinghouse Electric Corporation and as successor-in-interest to BF Sturtevant
c/o Eckert Seamans Cherin & Mellott, LLC
Case Management & Technology Center
600 Grant Street, 5th Floor
Pittsburgh, PA 15219

CHICAGO PNEUMATIC TOOL COMPANY LLC
c/o C T Corporation System
208 South LaSalle Street, Suite 814
Chicago, IL. 60604

CLARK-RELIANCE CORPORATION, INDIVIDUALLY AND AS SUCCESSOR IN INTEREST TO JERGUSON GAGE & VALVE COMPANY
c/o The Corporation Trust Company
1209 Orange Street
Wilmington, DE. 19801

CRANE CO.
c/o CT Corporation System
1108 E. South Union Ave.
Midvale, UT 84047

ELLIOTT COMPANY
c/o CT Corporation System
1108 E. South Union Ave.
Midvale, UT 84047

FLOWSERVE CORPORATION AS SUCCESSOR TO DURIRON INC. AND DURCO INTERNATIONAL INC.
5215 N. O'Conner Boulevard, Suite 2300
Irving, TX 75039

FLOWSERVE US INC., SOLELY AS SUCCESSOR TO EDWARD VALVES INC., ROCKWELL MANUFACTURING COMPANY, NORDSTROM VALVES INC. AND MCCANNA CORPORATION
c/o CT Corporation System
1108 E. South Union Ave.
Midvale, UT 84047

FMC CORPORATION, ON BEHALF OF ITS FORMER NORTHERN PUMP COMPANY
c/o CT Corporation System
1108 E. South Union Ave.
Midvale, UT 84047

GENERAL ELECTRIC COMPANY
c/o CT Corporation System
1108 E. South Union Ave.
Midvale, UT 84047

GORMAN-RUPP COMPANY
c/o Corporation Service Company
50 West Broad Street
Suite 1300
Columbus, OH 43215

VIAD CORP. f/k/a the DIAL CORPORATION, individually and as successor in interest to GRISCOMB-RUSSELL COMPANY
c/o CT Corporation System
1108 East South Union Avenue
Midvale, UT 84047

The Gorman-Rupp Company, individually and as successor-in-interest to Griscomb-Russell Company
c/o Corporation Service Company
50 West Broad Street
Suite 1300
Columbus, OH 43215

GOULDS PUMPS, INCORPORATED
c/o CT Corporation System
1108 E. South Union Ave.
Midvale, UT 84047

GREENE TWEED & COMPANY, INC.
2075 Detwiler Road,
Kulpsville, Pennsylvania 19443

GRINNELL LLC
c/o CT Corporation System
1108 E. South Union Ave.
Midvale, UT 84047

HERCULES, LLC
c/o The Corporation Trust Company
1209 Orange Street
Wilmington, DE 19801

IMO INDUSTRIES, INC.
c/o CT Corporation System
1108 E. South Union Ave.
Midvale, UT 84047

ITT LLC
c/o The Corporation Trust Company
1209 Orange Street
Wilmington, DE 19801

MILWAUKEE VALVE COMPANY INC.
c/o CT Corporation
301 S. Bedford Street, Suite 1
Madison, WI. 53703

MW CUSTOM PAPERS, LLC
c/o The Corporation Trust Company
1209 Orange Street
Wilmington, DE. 19801

ROBERTSHAW CONTROLS COMPANY
c/o The Corporation Trust Company
1209 Orange Street
Wilmington, DE. 19801

STERLING FLUID SYSTEMS (USA) LLC
2005 Dr. Martin Luther King Jr. Street
Indianapolis, IN. 46202-1165

VELAN VALVE CORPORATION
94 Avenue C
Williston, VT. 05495-9732

WARREN PUMPS, LLC
CT Corporation - Los Angeles
818 West 7th Street, 2nd Floor
Los Angeles, CA 90017-3407

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Salt Lake City, Utah 84111
Telephone: (801) 323-5000

Attorneys for Defendant Viad Corp. f/k/a
The Dial Corporation

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF UTAH, CENTRAL DIVISION

HOWARD WADE AND DEANNA LYNN WADE, Plaintiffs, v. INDUSTRIAL SUPPLY COMPANY, INC. et al., Defendants.	**DECLARATION OF CHARLES E. CUSHING, Ph.D., P.E.** Case No. ____________

Pursuant to 28 U.S.C. § 1746, I, Charles E. Cushing, Ph.D., P.E., under penalty of perjury and of my own knowledge, declare and states as follows:

1. I am the president of C.R. Cushing & Co., Inc., Naval Architects, Marine Engineers and Transportation Consultants. Attached as Exhibit 1 is a true, complete and correct copy of my curriculum vitae. I respectfully submit this Affidavit in support of any assertion that Viad Corp ("Viad") has been sued in its capacity as a person acting under an officer or agency of the United States within the meaning of 28 U.S.C. § 1442(a)(1). This Declaration is based upon my experience, education and training as a naval architect and marine engineer, which includes

my involvement in the design, construction, and/or conversion of more than 250 ocean-going vessels. It is also based upon my knowledge, experience, research and familiarity of and with the history of the design, construction and operation of the United States Naval vessels during World War II. This includes knowledge and familiarity with the contracting practices and requirements utilized by the U.S. Navy in constructing these vessels and as applied to its suppliers and contractors.

2. Plaintiffs allege in this case that Viad is the successor in interest to Griscom-Russell Company ("Griscom-Russell"). Plaintiffs further allege that Plaintiff Howard Wade was exposed to asbestos while serving in the United States Navy from November of 1968 to August of 1973 in the locations of San Diego, CA, Great Lakes IL, and Long Beach, CA.

3. Griscom-Russell is a defunct company that manufactured evaporators and fuel oil heaters used on some U.S. Navy vessels in the 1940s and 1950s.

4. The United States Navy was intimately involved in the manufacture of any Griscom-Russell equipment used on U.S. Navy vessels, as the equipment manufactured for those vessels was designed and built to meet precise and exacting specifications of the U.S. Navy. Moreover, pursuant to the U.S. Navy's specifications, Griscom-Russell would not have been able to affix to its products any type of warning or cautionary statements concerning alleged health hazards from the installation, use or maintenance of the products. Whether certain equipment used aboard U.S. Naval vessels should have warnings, and the content and format of any such warnings, was determined solely by the U.S. Navy. Griscom-Russell would have had no discretion whatsoever to affix any warnings of its own to products it delivered for installation on Navy ships.

5. Moreover, the U.S. Navy had precise specifications for any informational manuals delivered with Griscom-Russell equipment. Again, Griscom-Russell would have had no discretion to deviate from such specification, and U.S. Navy participated intimately in the preparation of this kind of information and exercised specific direction and control over contents.

6. The Griscom-Russell equipment manufactured for use on U.S. Navy vessels would have been manufactured without any insulation and shipped to the shipyards without insulation. The equipment would have been totally insulated at the shipyard, or after installation on the vessels, by others using insulation purchased from others. The U.S. government specified, designed and approved very precise specifications governing how the shipyard should insulate the equipment and the type of materials the shipyard should use to insulate the equipment.

I declare under penalty of perjury that the foregoing is true and accurate. Executed this 10 day of February, 2022.

Charles R. Cushing
CHARLES R. CUSHING

Curriculum Vitae of Charles R. Cushing

EXHIBIT 1

TO DECLARATION OF
CHARLES R. CUSHING

CHARLES R. CUSHING, Ph.D., P.E.

Employer: C. R. Cushing & Co., Inc.
Naval Architects, Marine Engineers & Transportation Consultants
30 Vesey Street, 7th Floor
New York, New York 10007

Position: President

Education: U. S. Merchant Marine Academy, B.S. (Marine Transportation) 1956
Massachusetts Institute of Technology, B.S. (Naval Architecture and Marine Engineering) 1960
State University of New York, M.S., (Ocean Transportation) 1972
University of Wales, Cardiff University, Ph.D. (Maritime Studies), 1997

Experience:
C. R. Cushing & Co., Inc., is a firm of naval architects, marine engineers and transportation consultants founded in 1968 by Charles R. Cushing. Dr. Cushing has been responsible for the design, construction, conversion, repair and/or refurbishment of over 250 ocean-going vessels in most major shipyards in the U.S., Europe and the Far East.

Dr. Cushing has personally directed and/or executed the concept, contract design, strategic planning, plan approval, supervision and construction of: tankers, tank barges, containerships, LNG ships, tugs, bulk carriers, roll-on/roll-off vessels, offshore pipe laying vessels, jacket delivery barges, passenger ships, and other types of vessels.

Risk analyses, safety audits, energy audits, corrosion studies, vessel maintenance, manning, collision avoidance, pollution prevention, navigation, coatings, automation, pumping, noise, vibration, hydrodynamics, and air quality monitoring typify the fields of Dr. Cushing's expertise.

Assignments ranging from port and terminal projects, economic analyses, material handling studies, marine operation and maintenance studies, automation studies, planned maintenance and repair systems all fall under his realm of expertise. He has been responsible for the design of numerous types of intermodal shipping containers; the purchase, inspection, and testing of containers, container refrigeration equipment, container chassis, and container handling equipment. He authored the United States Coast Guard Tankerman's Manual.

Dr. Cushing served as Chief Naval Architect at Sea-Land Service, Inc. from 1961 to 1968 where his accomplishments include the design and conversion of 45 containerships, the development of cranes and cargo handling systems. He holds a number of patents in maritime and intermodal technology.

Prior to his graduation from MIT, he sailed as a cadet and a licensed deck officer on a number of U.S.-flag general cargo and passenger vessels. He has been involved in cargo handling operations in the United States, South America, Southeast Asia, Australia, New Zealand, the Far East, Middle East, Africa, and Europe.

Professional Associations:

American Bureau of Shipping, Naval Architecture Committee, Past Member,
American Bureau of Shipping, Committee on Cargo Containers, Past Member
American National Standards Institute MH5 Committee, Member
American Society of Heating, Refrigeration and Air Conditioning Engineers, Member, No. 3031973
American Society of Mechanical Engineers, Fellow, No. 261040
American Society of Naval Engineers, Naval Member, No. 00549
Charter Engineer, U.K., Engineering Council No. 152957
Chemical Transportation Advisory Board, Past Member
Chemical Transportation Advisory Board Subcommittee on Bulk Terminals/Tank Vessels, Past Member
EuroEngineer, European Union
Global Maritime and Transportation School (GMATS), Member, Board of Directors to 2012
Institute of Marine Engineering Science and Technology, Fellow
Instituto Pan Americano de Ingenieria Naval, Member IM-605
International Cargo Handling and Coordination Association, Member
International Standards Organization, TC-104, Past U.S. Delegate
Japan Society of Naval Architects and Ocean Engineers, Member
Korean Society of Naval Architects, Member
Professional Engineer, State of Mississippi, Reg. No. 03537
Lloyds Register of Shipping, U.S. Committee, Past Chairman; Technical Committee, Past Chairman
Marine Board, Member, 2004 to 2010
Maritime Resource Center, Past Chairman
MIT Club of New York, Member
National Academy of Engineering – Elected 2004
National Academy of Sciences - NRC, Ship Structures Committee, Past Member
National Fire Protection Association, Member No. 105205
National Shipbuilding Research Program, Blue Ribbon Panel Member
National Safety Council, Member
New York City Port Council, Past Member
New York Yacht Club, Member
North East Coast Institution of Engineers and Shipbuilders, Past Member
Nautical Institute, Member No. 98 12550
Royal Institute of Naval Architects, Fellow
Royal Institute of Navigation, Member
Society of Maritime Arbitrators, Member
Society of Naval Architects and Marine Engineers, Life Member, Fellow, No. 1080010
SNAME Fellows Committee, past Chairman
SNAME Finance Committee, Member
SNAME Ship Technical Operating Committee, Member
Sperry Board of Awards, Chairman 1991/1992
State University of New York (Maritime College), Engineering Advisory Committee, Member
U.S.C.G., SOLAS Working Group on Container Safety - Member and past U.S. Delegate
U.S. Merchant Marine Academy, Trustee, 2005 to 2007.
U.S. Merchant Marine Academy Alumni Association, President, 1986-1990
U.S. Merchant Marine Academy, Engineering Advisory Board, Member
U.S. Merchant Marine Academy Foundation, Chairman, 1982-1986
Webb Institute (Naval Architecture), Board Member; Fellow; Executive Committee; Finance Committee; Chairman; Audit Committee; Planning Committee to 2010
Naval Studies Board 2008 to date

Awards:

The Admiral E.S. Land Medal for Excellence in Naval Architecture, USMMA, 1956
The Marine Man-of-the-Year, 1970, USMMA/SNAME
The Alumnus-of-the-Year, 1991, USMMA
The International Maritime Hall of Fame, 2000
The Admiral E.S. Land Medal for Outstanding Contributions in the Marine Field, SNAME, 2000

Other Professional Activities:

- Authored numerous publications for professional societies, trade publications and industry conferences. Contributed chapters in the Society of Naval Architecture and Marine Engineers' Ship Design and 1993 Historical Transactions.

- Adjunct Professor at World Maritime University in Malmo, Sweden and Dalian, China teaching The Ship_Acquisition Process and Maritime Accident Investigation, 1987 to date.

- Lecturer at Massachusetts Institute of Technology, Webb Institute, University of Michigan, United States Merchant Marine Academy, Industrial College of the Armed Forces, Marine Engineers Beneficial Association, GMATS, and elsewhere.

- Serves as a director, officer or committee member of numerous educational, professional and industry organizations.

- Chairman, founder and principal shareholder in Oiltest, Inc.

- U.S. Naval Reserve, 30 years, retired 1982.

- Member National Academy of Engineering, elected 2004.

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Los Angeles, CA 90071
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Facsimile: (213) 283-2101

Attorneys for Defendant
VIAD CORP

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

GENEVIEVE SCHROEDER, KEITH SCHROEDER, CRAIG SCHROEDER, Plaintiff, vs. A.W.CHESTERTON COMPANY: FMC CORPORATION as successor in interest to NORTHERN PUMP COMPANY; GENERAL ELECTRIC COMPANY; GOULDS PUMPS (IPG), INC.; IMO INDUSTRIES INC., individually and as successor in interest to DE LAVAL TURBINE, INC., and WARREN PUMPS, INC.; INGERSOLL-RAND COMPANY, individually and as successor in interest to TERRY STEAM TURBINE COMPANY; METALCLAD INSULATION CORPORATION; RAPID AMERICAN CORPORATION; VIACOM, INC., individually and as successor by merger to CBS CORPORATION f/k/a WESTINGHOUSE ELECTRIC	Case No: CV11-00738 R (VBKx) **DECLARATION OF REAR ADMIRAL (USN, RETIRED) BEN J. LEHMAN IN SUPPORT TO DEFENDANT VIAD CORP'S OPPOSITION TO PLAINTIFFS' MOTION TO REMAND** **DATE: March 21, 2011** **TIME: 10:00 a.m.** **DEPT.: 8**

CORPORATION successor-in-interest to BF STURTEVANT CO.; VIAD Corp, f/k/a THE DIAL CORPORATION, individually and as successor-in-interest to GRISCOM-RUSSELL COMPANY; YARWAY CORPORATION; FLOWSERVE dba BYRON JACKSON PUMPS and DOES 1 through 100, Inclusive,

Defendants.

DECLARATION OF REAR ADMIRAL (USN, RETIRED) BEN J. LEHMAN

I, Ben J. Lehman, under penalty of perjury and of my own personal knowledge, state the following:

1. I am a retired Rear Admiral of the United States Navy. Before joining the Navy in 1942, I received a Bachelor of Mechanical Engineering degree from the College of the City of New York. After joining the Navy, I was ordered to study naval architecture and marine engineering at Massachusetts Institute of Technology (MIT). Later, I completed the United States Post-Graduate School program in Naval Engineering Design at the Naval Academy in Annapolis. The curriculum was primarily in electrical and mechanical engineering. I received a Master of Science in Mechanical Engineering from Harvard University in 1949. I have also studied Design Philosophy and Advanced Stress Analysis at Stanford University.

I joined the United States Navy in 1942 and remained on active duty until 1946. While on active duty in the United States Navy, I served as Ship Superintendent and Dry Docking Officer at the Brooklyn Navy Yard between 1942 and 1944.

In 1946, I left active duty and joined the Naval Reserve. In 1950, I retnrned to active dnty and was assigned as a Ship Snperintendent at the San Francisco Naval Shipyard from 1950 to 1952. I was then transferred to the Assistant Indnstrial Manager Office in San Francisco from 1952 to 1954 as a Planning Officer.

In 1954, I returned to the Naval Reserve where I was a member and then Commanding Officer of Naval Reserve Engineering Companies.

I was promoted to Rear Admiral in 1977 in the Naval Reserve.

I worked as an engineer at General Electric Company between 1946 and 1948. I held the positions of Director of Engineering and Vice-President of Engineering at two major ship building companies between 1969 and 1975. Dnring all these periods, I have maintained close contact with the U.S. Navy, including periods of active duty in the Department of Defense and the Naval Sea Systems Command in Washington, D.C. I have been an independent consultant since 1975 providing engineering consultation services to various industries inclnding the shipbuilding indnstry. Dnring my Naval service, I have personally been responsible for the creation of Navy specifications for the procurement of materials and machinery for use on Navy ships. A true, complete and accnrate copy of my curricnlnm vitae is attached as Exhibit 1.

2. Based on my experience, professional training and edncation, I am familiar with the plans, designs and specifications used in the construction and repair of commercial and Navy ships. In addition, I am familiar with Navy specifications, equipment manuals and qualified products lists which are used in the constrnction and repair of Navy and commercial ships. I am also familiar with the Navy regnlations regarding the use, placement and repairs or maintenance of asbestos prodncts generally dnring the periods in which they were used and the Navy regulations regarding such maintenance, technical manuals and warnings permitted by the Navy.

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3. I submit this Declaration to attest to the level of supervision and control by the United States Navy and its officers over every aspect of the design, manufacture and use of equipment intended for installation on Navy vessels.

4. During my service in the Navy as a Ship Superintendent, I was personally involved with the supervision or oversight of ship alterations and equipment overhauls at the New York Naval Shipyard (formerly the Brooklyn Navy Yard) and at the San Francisco Naval Shipyard (Hunter's Point).

5. During the 1940s and 1950s, the Navy generally utilized a system of ship design and construction that established and set the designs of ships, which designs were known to the Navy to meet particular performance capabilities. The Navy then restricted any deviations from such designs by any suppliers and/or contractors. When a change in the design and/or construction of a ship was required, the Navy would oversee, control and approve all aspects of the change. Design drawings were prepared by the design agent for the Navy or by the Navy itself. The Navy reviewed and approved the drawings and then submitted them to the individual suppliers and contractors to use in the manufacturing, supply and/or installation of the equipment and the construction of the ship. These pertained to the original designs, as well as changes initiated and controlled by the Navy.

6. I have reviewed various documents submitted by Buffalo Pumps in connection with its removal and related briefing in William A. O'Connell v. Foster Wheeler Energy Corp., et al., Civil Action No. 08-10078-RGS (D. Mass). As an aid to the Court, I submit herewith as Exhibit 2 an affidavit of Navy Rear Admiral David Sargent, Jr., and also the documents attached as Exhibit L to the Sargent affidavit; and I submit herewith as Exhibit 3 an affidavit of Buffalo Pumps' production manager Martin Kraft, and also the documents attached as Exhibit C to the Kraft affidavit. I have read both affidavits, including these exhibits, and am familiar with their content. Based upon my personal experience,

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these documents attached to both affidavits are typical of the Navy's detailed attention to and control over the content of submissions, and the type of correspondence that the Navy used to reject submissions of, and to require corrections and resubmissions by, its various contractors. In my experience, such preliminary drafts and responsive comments were more typically discarded than retained, which may serve to explain why more such documents have not turned up.

7. Any deviation from military specifications of equipment to be installed on ships would have resulted in significant problems and probable rejection of the equipment. The Navy could not, and did not, permit its contractors to implement any changes because every aspect of every item of equipment had to be: (1) functionally compatible with every other item of equipment and with available materials from the Navy Supply System; (2) compatible with shipyard practices, training, tools and capabilities; and (3) consistent with the ability of the crew in maintaining the ship during its service using materials carried on board when shipyard help was not available.

8. In the 1940s, 1950s and afterward, the Navy had complete control over every aspect of each piece of equipment. Military specifications governed every characteristic of the equipment used on Navy ships, including the instructions and warnings. Drawings for nameplates, texts of instruction manuals, and every other document relating to construction, maintenance, and operation of the vessel were approved by the Navy. This control included the decision of what warnings should or should not be included. Thus, the Navy controlled the decision making with respect to instructions and warnings on every piece of equipment.

9. The Navy had specifications as to the nature and content of all written material that was delivered with each piece of equipment. The Navy was intimately involved with and had final approval of all technical and engineering drawings, operating manuals, safety or hazard information and any other written

information that accompanied a piece of equipment. The Navy determined the nature of hazards to be subject to any precautionary labeling and the content of any such labeling. In short, the Navy dictated every aspect of the design, manufacture, installation, overhaul, written documentation and warnings associated with its ships and did not permit deviation by any of its contractors.

10. The Navy specified the use and placement of insulation, including asbestos insulation, on Navy ships during World War II and the 1950s. Mechanical equipment for use aboard Navy ships was delivered without insulation. This was to prevent damage to the insulation during shipment and installation, and to allow the equipment to be effectively connected to other equipment and systems on board, which connections as well as the equipment could then be effectively insulated. If mechanical equipment was to be insulated, it was not insulated by the manufacturers, but rather by shipyard personnel.

Shipyards and shipyard personnel were solely responsible for installing and insulating the equipment. Insulation was installed in accordance with plans, specifications, and schedules developed for and controlled by the Navy. Based upon my experience, professional training, education and research, it is my opinion that the United States Navy was aware of the dangers of asbestos by the 1940s. Despite such knowledge, the Navy did not provide any warnings. The research by LCdr S. A. Forman, MC, U.S. Navy [Par. 13g, below] supports my opinion.

11. Based upon my experience, professional training, education and research, it is my opinion that equipment suppliers were prohibited from providing any warnings to be placed on or to accompany equipment supplied to the Navy without the consent and approval of the Navy. Moreover, certain types of warnings would not have been approved by the Navy given the necessary performance needs and capabilities of the shipboard equipment, the ships and Navy personnel. This would have included, but not been limited to, any potential

warnings associated with asbestos including, but not limited to, recommendations regarding respiratory protection, and repair and maintenance practices. This was due to the inability to effectively and comprehensively observe, implement, and comply with such recommendations under the multitude of varying conditions likely to be encountered by Navy ships at sea, and especially at war.

All equipment and procedures had to be standardized to ensure that personnel were familiar with the procedures for operating, repairing and maintaining the equipment, and that the tools and equipment aboard ship or at ports world-wide were available to perform such procedures. Thus, a contractor or supplier could not provide warnings or recommendations without the consent and authorization of the Navy.

12. During the 1940s and early 1950s, the Navy did not have the tools, equipment and/or personnel capabilities to meet or comply with any potential warnings or recommendations pertaining to the health hazards of asbestos aboard ship, especially under the exigencies of war. Further, the Navy limited the areas of interest of each manufacturer to the equipment supplied by that manufacturer. Because equipment was required by the Navy to be supplied without insulation, it would have been improper and unauthorized for the manufacturer or supplier of such equipment to supply warnings or other recommendations with respect to insulation, which would not have been within its particular area of interest. As the manufacturer and/or supplier would not have been responsible for the insulation, it likely would not have been aware of any hazard associated with such insulation or required to determine whether any existed, and thus it had no ability or obligation to supply warnings about insulation. As the Navy would have been the entity that required the insulation, designated the type and placement of the insulation, and directed a different entity to supply, install it, or both e.g., the shipyard, the Navy's knowledge of any potential hazards associated with the insulation would have been equal or superior to that of the

equipment manufacturers and suppliers that provided the uninsulated equipment.

13. Based upon my review of many documents regarding the Navy's hazard communication program, my career experience in the Navy, and personal knowledge of the Navy's hazard communication program and naval practices generally, I can state as follows:

a. Uniformity and standardization of any communication, and in particular safety information, are crucial to the operation of the Navy. The Navy could simply not operate if various personnel were trained differently and received additional inconsistent information from different manufacturers.

b. Asbestos insulation products began containing hazard warning labels from the insulation manufacturers in the mid-1960s. Prior to that time, beginning more than two decades earlier, the Navy's own occupational health program provided training, engineering and administrative controls, personal protective equipment, and medical surveillance to prevent the hazards of asbestos to shipyard workers.

c. Any additional warning about the hazards of asbestos by an equipment manufacturer would be only partial in scope as well as inherently redundant, eventually obsolete, and almost certainly inconsistent with the Navy's own training. The Navy could not permit unauthorized hazard labels which might interfere with the abilities of sailors to perform their duties in the heat of battle.

d. At most, it is possible that manufacturers of equipment delivered to the Navy without insulation could merely have told personnel to follow the Navy's own mandates for handling asbestos. This redundant information is not informative, diverts attention from hazards inherent in the equipment, and would certainly become obsolete. Equipment aboard Navy vessels last many years and the Navy's asbestos hazard communication

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program evolved over the years to keep pace with scientific developments and changes in materials.

e. If each equipment manufacturer (and conceivably even the pipe and structural steel manufacturers) provided its own warning about asbestos insulation that might be used on or around its product, inconsistent warnings would certainly have resulted. Many other hazardous substances (for example boiler feed water chemicals, fuels, solvents, heavy metals) are used in conjunction with the multitudes of equipment on a ship. If each was to warn about all the possible substances that might be used on or around its equipment, sailors would quickly become inundated with inconsistent information on myriad substances.

f. Some types of insulation used by the Navy on equipment were non-asbestos (e.g., fiberglass blankets) and any general warning about asbestos on such equipment would simply be wrong. In fact, asbestos was designated as a "critical material" by the Army and Navy Munitions Board on or about January 30, 1940. See Exhibit 4. The Navy directed that substitutes for asbestos, including fiberglass, cotton duck lagging and hair felt, should be used where possible, including on low temperature pieces of equipment in order to conserve available asbestos. See Exhibit 5.

g. Based on my experience, the United States Navy, as the biggest user of asbestos in World War II, and thereafter in shipbuilding, was more knowledgeable about any hazard of asbestos than any of the vendors who supplied it and upon whom plaintiff seeks to impose a duty not consistent with or imposed by the above naval specification. In Par. 10, I mentioned the extent of the Navy's knowledge with regard to asbestos. As an aid to the Court, I submit herewith as Exhibit 6 an affidavit of Samuel A. Forman, M.D., with attached exhibits, with which I am thoroughly familiar from various other litigations involving the U.S. Navy. Dr. Forman compiled the

documents attached to his affidavit while detailed by the Navy and under Navy orders to perform an investigation into the state of Naval hygiene and asbestos. I agree with the conclusion of Dr. Forman that the state of knowledge of the United States Navy regarding hazards of asbestos was quite complete when compared to available knowledge at the time of World War II, and that by 1940, the United States Navy was a leader in the field of occupational medicine relating to, among other things, asbestos exposure. I myself, was exposed to asbestos in inspecting the work of insulating shops under my supervision during my tenure at the Brooklyn Navy Yard and also in San Francisco. Accordingly, my interest in the Navy's knowledge in this field was both personal and professional, and continuing to this day.

I have reviewed all of the exhibits attached to the affidavit of Dr. Forman including the article attached as Exhibit C thereto, as well as the documents listed above in sub-paragraph (f), which I saw in the course of my duties as a naval officer, as either official United States Navy Documents or articles reproduced from recognized and reputable magazines and reviews of the kind relied upon by experts.

14. Based on my experience, the United States Navy is bound by its own regulations and would not permit any vendor gratuitously to do anything not provided for in its own regulations. The Navy would not allow any warnings to be placed on any product without specific authority by way of an order or a regulation.

Therefore, I conclude:

The information possessed by the Navy with respect to the specification and use of asbestos, and the health hazards associated with its use aboard Navy vessels, represented the state-of-the-art and far exceeded any information that possibly could have been provided by manufacturers of Naval equipment. Based upon the knowledge at a given period in time, the Navy was

fully aware of the recognized health hazards of asbestos and had a robust program to control exposure of personnel and monitor their health.

There was no information concerning any asbestos hazard or danger posed by any asbestos-containing product applied to any equipment on a United States Navy ship known to a manufacturer of equipment that was not previously known to the United States and the United States Navy.

It would be unreasonable to assume that the Navy would have accepted gratuitous comments from equipment manufacturers about hazards associated with a product they neither made nor sold and about which the Navy was already aware.

I declare under penalty of perjury that the foregoing is true and correct. Executed this 2 day of March 2011.

Ben J Lehman

Ben J. Lehman, Rear Admiral (USN, Ret.)

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Curriculum Vitae of Rear Admiral Ben J. Lehman (Ret.)

EXHIBIT 1

TO DECLARATION
OF REAR ADMIRAL BEN J. LEHMAN (RET.)

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Ben J. Lehman
Rear Admiral U.S. Navy (Engineering) Retired
Professional Engineer, Safety Professional President - Mech Elex Tex, Inc.

Education:

College of the City of New York [CCNY], Bach. of Mechanical Engineering	(1942)
Massachusetts Institute of Tech. [M.I.T.], Naval Architecture (4 months)	(1942)
U.S. Navy Post-Graduate School, Electrical and Mechanical Engineering	(1945)
Harvard University, M.S. in Mechanical Engineering	(1949)
Stanford University, Design Philosophy and Advanced Stress Analysis	(1957-59)

Forensic Experience:
Testified in court over 50 times regarding ;

Ship Design, Construction and Repair, Product Defects

Safety Engineering including Warnings and Training;
Construction Practices and Equipment; Electrical Equipment;

Professional Recognition:
Registered Professional Engineer: New York (1949), California (1953), [Emeritus:Alabama (1976), Louisiana (1976)] Florida (1976:lapsed)
Certified Safety Professional (1979-2004: discontinued in 2004)

Career Experience:

Ship superintendent and planning officer, [U.S. Navy- Ensign to Lcdr]	(1942-46 + 1950-54)
(Promotions in the Naval Reserve: Cdr-1957, Captain-1962, Rear Admiral-1977; retired 1982)	
Engineer, General Electric Co. (1946-48) & Bethlehem Steel Shipbuilding Div.	(1949-50)
Engineer, Bechtel Corp. (1954-55) & Sylvania Electric Microwave Laboratory	(1955)
Project Engineer, Kaiser Aircraft and Electronics (1956-57) & Beckman Instruments	(1957-59)
Engineering Manager, Lockheed Missiles and Space Co.	(1959-69)
Director of Engineering, Lockheed Shipbuilding and Construction Co.	(1969-72)
Vice-President Engineering, Litton Industries & Ingalls Shipbuilding	(1972-75)
Independent Consultant	(1975 -present)

Affiliations:

Systems Safety Society	American Society of Naval Engineers
Society of Naval Architects & Marine Engineers	Society of Automotive Engineers
Institute of Electrical & Electronic Engineers (IEEE)	Risk Analysis Society

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Rev.5/09

Affidavit of Navy Rear Admiral David Sargent, Jr.

EXHIBIT 2

TO DECLARATION
OF REAR ADMIRAL BEN J. LEHMAN (RET.)

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William A. O'Connell v. Buffalo Pumps, Inc. et al.,
Civil Action 1:08-cv-10078-RGS,
United States District Court, District of Massachusetts

AFFIDAVIT OF DAVID P. SARGENT, JR.

STATE OF HAWAII)
) SS.
CITY AND COUNTY OF HONOLULU)

DAVID P. SARGENT, JR., being duly sworn, deposes and states under the penalties of perjury, as follows:

Background and Experience

1. I am a retired Rear Admiral of the United States Navy, in which I served between 1967 and 1999. I began my active naval career in 1967 after receiving a Bachelor of Science degree in Mechanical Engineering from Cornell University and receiving a commission in the Navy through the Naval ROTC program. Upon commissioning in the Navy, I attended the Cruiser-Destroyer Forces Pacific Fleet Engineering Officer's School in a course focused on the operation and maintenance of engineering plants of World War II era warships. In 1974, I received a Master of Mechanical Engineering degree from the Naval Postgraduate School, Monterey, California. In addition, I am a licensed Professional Engineer (Mechanical) with extensive operational experience in ship engineering, ship maintenance and at-sea operations.

2. My assignments from 1967 until 1988 were primarily involved with the operation and maintenance of Navy warships. Thereafter, I held a variety of program and technical management positions in the Naval Sea Systems Command program offices

where I was responsible for the design, construction, fleet introduction, in-service support, and modernization of various classes of warships. Upon selection to Rear Admiral in 1994, I was assigned as Commander, Naval Surface Warfare Center, a diverse organization of research laboratories and engineering stations responsible for research and development of all technical aspects of Navy surface ships and submarines. My final assignment before retirement in 1999 was as Program Executive Officer for Aircraft Carriers, Expeditionary Warfare and Auxiliary ships. In that position, I had overall responsibility for all matters relating to both the technical and programmatic details of design, construction, delivery and support of both new and in-service aircraft carriers, expeditionary warfare and auxiliary ships of the Navy.

3. I am now President of Sargent Enterprises, Inc., which includes two companies serving the maritime industries. SEI Associates, an engineering services business, provides technical and management support to maritime industries. SEI Marine Technologies is a company that operates and maintains various test and demonstration craft for research and development companies involved in developing new equipments and hull forms for future high performance ships. I have served for many years in active leadership of the American Society of Naval Engineers, and in 2001 and again in 2003 was elected to serve two consecutive two-year terms as president of that organization. I am also a member of the Sigma Xi Engineering Honorary Society, the American Society of Mechanical Engineers and the Cornell Engineering Alumni. Association.

4. As a Navy engineering officer and program manager, I was often called upon to assist in determining conformance of shipbuilders and equipment vendors to drawings and specifications prior to acceptance by the Navy. The chain of command within the

Navy concerning ship design and construction involves several layers of authority, particularly in the lines of command for technical and contractual control over Navy ship design, construction, maintenance and repair. Ultimately, the Secretary of the Navy has authority over the Navy including Navy shipbuilding design, construction and operation. During the 1940s, 1950s and 1960s, the Navy Bureau of Ships (BUSHIPS) (later known as NAVSHIPS and currently as NAVSEA) controlled all Navy ship design and construction.

5. I am knowledgeable from my own Navy service, and also from my education, training, research and experience with the historical practices and procedures employed by the Navy in the design and construction of vessels and the operation of its vessels and facilities.

Navy Warships are Unique and Complex

6. Warships must be designed to meet very demanding performance requirements such as high speed and firing of weapons, the ability to safely carry and employ a vast array of explosives and ammunition, the ability to operate for long periods at sea without support or replenishment, and do all these missions both in peacetime and in combat.

7. Navy warships are some of the most complex machines ever designed and constructed. They are high-speed, floating, heavily armed communitites that must support hundreds of crew members and a vast array of complex systems for months at sea. Ships are the only machines sufficiently large, complex and mobile that the operators must live inside the machines they operate. Thus, warships of all sizes and types contain all the facilities of a community plus multiple the armaments and ammunition. Major characteristics and capabilities include a sturdy and survivable hull

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form, high performance propulsion systems, electrical power generation to support all needs, fresh water distilling systems, food storage, preparation, and eating spaces as well as clean up, living spaces, laundry services, medical spaces, library, firefighting and damage control capabilities, and many other services.

8. An example will help to illustrate the immense task faced by the Navy in designing warships. Among the vessels constructed by the Navy during the general period in question were the so-called *Forrestal* class aircraft carriers. These ships were designed and constructed during the 1950s and served the Navy into the 1990s.

9. The *Forrestal* class carriers were 1,063 feet long, with an extreme width of 252 feet. They displaced about 80,000 tons. Their draft, or depth below the waterline, was approximately 37 feet (about the height of a 4 story building). The overall height of the ships was greater than the height of a 25 story building, and they had 19 different "levels" or floors. The flight deck from which aircraft took off and landed was approximately four acres in size, and the hangar bay consumed an additional two acres. The vessels had approximately 3,000 separate compartments or rooms, ranging in size from small offices to engineering spaces the size of gymnasiums. The onboard storerooms were equal in size to a six-story building. It took about 300,000 gallons of paint to paint the entire ship. There were multiple large food preparation and serving areas to feed the crew around the clock.

10. The *Forrestal* class carriers were capable of speeds in excess of 30 knots (about 36 mph), produced more than 200,000 gallons of fresh water a day by distilling salt water, and carried several hundred-thousand gallons of ship and aviation fuel. Each had eight large turbo-generators that produced enough electricity to power a good sized

city. The Navy estimates that the ships had more than 10,000 miles of electrical cable installed and many miles of piping. The ships carried more than 80 aircraft each, and they had crews of more than 5,500.

11. Navy warships must be designed to operate effectively in very harsh and hostile environments, to survive battle damage and fight again, and to meet demanding speed and maneuvering requirements. Over time, the specific types of enemies, weapons and combat which Navy ships must face has changed, from a focus on surface-to-surface combat involving heavy guns to greater use of aircraft and missiles. These changes have created fundamental changes in the design and construction of Navy vessels.

12. Beginning in and following World War II, the aircraft carrier became the most significant type of surface ship. An aircraft carrier must use high speed to create wind over the deck to launch and recover aircraft. The result was an overall increase in the speed demanded of Navy vessels of all types, whether carriers or the support and escort vessels that accompany them. To meet these demands, Navy designers had to develop significantly higher horsepower propulsion plants. It was also imperative that this increased power be achieved without significant increase in either the size or the weight of the propulsion plant, since increased size and weight would require even more horsepower.

13. The unique aspects of Navy warship design and development placed other requirements on the Navy establishment. Since there was no U.S. industry that either designed or assembled these high performance propulsion plants, the Navy had to undertake itself the design of these complex and state-of-the-art warships, and had to develop ways to verify the performance and reliability of these new designs. To

accomplish this, the Navy maintained an engineering establishment with many different engineering specialties. The Navy had the most diverse and advanced engineering workforce in the nation. Additionally, verifying the performance of these new propulsion designs required that the Navy engineering organization build large shore-based laboratories in which they assembled and operated prototypes of these propulsion plants. These prototypes served many uses including verifying performance, validating reliability, and developing optimum operating procedures.

Navy Vessels – Concept to Operational – The Process

Cost and Feasibility Studies

14. Prior to the 1940s through the 1970s and even today, the design of a Navy warship started with the establishment of naval war fighting requirements at the national level. Examples included requirements such as the need to ensure that sea lanes in international waters could not be denied by an enemy, the need to detect and neutralize hostile ships, submarines, and aircraft that might threaten U.S. or allied coasts, the need to transport and operate aircraft near enemy territory, and the need to transport and debark Marines anywhere in the world. From requirements such as these, various ship concepts were formulated.

15. Rigorous feasibility studies were done on these concepts by both seasoned naval operators and by experienced ship engineers and designers to validate and mature the concepts, and to develop initial cost estimates for budgeting and congressional funding requests. A final ship concept design emerged, describing such parameters as approximate physical size and displacement of the ship, what weapons and sensors would be used aboard, what speed it was required to achieve, what range it must be able to

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achieve without refueling, and how long it must operate at sea without replenishment. Typically, it took a year or more to progress from a defined new warship requirement set to an agreed to concept design to meet those requirements.

Preliminary Design

16. The next step in the creation of a new warship during the time periods in question was the conversion of the concept design into a preliminary design package that contained sufficient details of the structure and all ships systems to allow engineers to verify that the ship would meet established requirements. During preliminary design Navy engineers determined all equipment arrangements, the weight and stability of the ship, a detailed understanding of the ship's displacement and powering requirements, and a much better cost estimate. Work included investigation of details such as identification of what materials and technologies existed or could be developed in time to achieve the performance of each system, and ensuring that these technologies and design details could in fact be manufactured and integrated into a completed warship were considered and addressed.

17. The preliminary design phase was accomplished by dividing the very complex ship into many groupings and sub-groupings such as hull design, propulsion, electrical, deck equipment, messing and berthing, medical, navigation, weapons, sensors, and auxiliary systems to name just a few. During this preliminary design phase, engineers had to develop and document the performance, configuration, and location of each system and piece of equipment that is required to meet the overall ship performance requirements.

18. The preliminary design also had to comply fully with extensive Navy warship

design General Specifications and other design guidance developed over many decades of experience. Examples include aspects such as how much damage the ship must be able to experience and still remain operable, what levels of shock from battle damage equipment must withstand and remain operational, and what fire fighting and damage control capabilities must be included in the design. At the completion of the preliminary design and related documentation, the Navy was confident that the ship and all included systems and equipments would function as designed and would meet the war fighting requirements.

19. Although the time to develop a preliminary design varied greatly depending on the size and complexity of the warship, typically for a destroyer-type warship, the preliminary design required six months to a year and thousands of man-years of engineering work.

Development of the Contract Design package:

20. The next phase in progressing from a ship design to an operational warship was the contract design process, in which the preliminary designs were converted into documentation of proper format and sufficient details for use in the government acquisition contracting process. In essence, this effort was to "design" the procurement contract.

21. The complex ship systems and subsystems described in the preliminary design were typically comprised of a myriad of individual mechanical and electrical components connected together in intricate ways. During the contract design phase, Navy engineers had to confirm that sources existed from which the specified materials, equipments, and consumables could be obtained. However, usually there was no one

source from which the Navy could obtain these complex warship systems and subsystems. Rather, sources had to be identified for individual components that could later be assembled into the Navy's complete systems. Thus, the Navy typically had to procure, for each vessel, countless individual components from dozens of individual suppliers and sources. Examples of components associated with just the propulsion systems on Navy warships include specific types of steel and fasteners, pipe and fittings; pumps, valves, turbines, condensers; electrical motors, generators, and switchboards; gauges, meters, alarms; boilers, condensers and reduction gears. During World War II and well into the 1960s, virtually all equipment that was to be installed in warships was procured by the Navy and provided to the building shipyard as government-furnished equipment.

22. This detailed design of all equipment, subsystems, systems, and the entire ship also was required to comply fully with a plethora of Navy design guidance developed from previous experience. For example, the Navy sets and follows internal standards and requirements regarding such matters as levels of redundancy necessary to preclude single points of failure, standardization of consumables and spare parts amongst different equipments, systems and with other warship classes, crew operating environmental requirements such as temperature, noise, lighting, equipment labeling, standard Navy identification and labeling of decks, doorways, compartments, and equipment, and housekeeping matters such as heating and ventilation, food storage preparation and serving, and laundry requirements.

23. The contract design package when complete included the entire set of Ship Specifications with detailed design information, the contract plan for procuring all

equipment as well as contracting for ship construction, and the multitude of individual requests for proposals that were required to describe every piece of material, equipment and subsystem that had to be procured to allow construction of the warship. The development of the contract design package involved multiple government decisions. Examples include decisions which were subject to various Navy and other federal guidance and regulations, such as Federal Specifications, Federal Acquisition Regulations and Defense Federal Acquisition Regulations.

24. The Navy developed specifications called, since the 1950s, Military Specifications (MILSPECs) for use in the contract design package. Thousands of MILSPECs were developed for various specific materials, equipment, components, books, manuals, label plates, etc. These MILSPECs presented very detailed descriptions of what the government required when procuring the items covered by the MILSPECs, including requirements such as chemical composition, dimensions, required testing and performance demonstrations, required labeling, packaging and shipping requirements, and similar content. These specifications typically cross-referenced and invoked other specifications.

25. The Navy maintained the responsibility to develop the MILSPECs and other standards for the manufacture and supply of equipment used in the construction, maintenance and repair of Navy ships. Specifications for any equipment intended for use aboard Navy ships were drafted, approved and maintained by the Navy. Once promulgated, only the Navy could make changes or modifications to those specifications. MILSPECs were prepared by hundreds of Navy engineers highly qualified in specialty areas such as, among many other things, pumps, steam turbines, gas turbines, reduction

gears, ship propulsion, and auxiliary equipment.

26. This specification system was initiated in the 1930s and was expanded in both scope and detail for use in the procurement of the large number of complex warships procured in the World War II timeframe and since. The technical specifications system always included a disciplined revision and change process to ensure technical specifications were kept current and reflected changing requirements, technology, materials, and other related updates. Manufacturers of components, such as pumps, procured by the Navy for use in warships were required to comply with technical specifications in all details in order for the Navy to accept the equipments being manufactured, tested, and shipped.

27. Examples of MILSPECs issued by the Navy for centrifugal pumps of the type manufactured by Buffalo Pumps are attached as Exhibits A and B. Notably, among numerous other detailed requirements, both required that internal gaskets in the pumps be "asbestos sheet gaskets."

28. Navy specifications were communicated to vendors such as Buffalo Pumps when the Navy (or private entities, such as shipyards or professional design firms) issued Requests for Proposal (formerly called Invitations for Bid) for the manufacture or supply of certain equipment. Compliance with the standards and specifications issued for equipment supplied for ultimate use aboard Navy ships was directly monitored by Naval Machinery Inspectors under both of the following divisions: (a) Machinery Inspectors under the Bureau of Supplies and Accounts worked on-site at vendor facilities, such as Buffalo Pumps' manufacturing facility; and (b) Machinery Inspectors under BUSHIPS carried out their responsibilities at the shipbuilding yards. The Machinery Inspectors

ultimately worked for the Secretary of the Navy or the Secretary of War. These Inspectors exercised primary, front line control and direction over the work performed for the Navy by original equipment manufacturers, regardless of whether the equipment was being constructed or supplied pursuant to a Navy or private contract. Buffalo Pumps equipment could not have been installed aboard Navy vessels unless that equipment was first determined by the Navy to be in conformity with all applicable Navy specifications.

29. The incredible level of detail contained in these specifications is necessary to ensure complete and common understanding between the government and vendors of what it is the government requires and is committing to pay for, to ensure commonality across systems with similar components, and to ensure that replacement parts, equipment and consumable materials, some provided by different manufacturers, will all perform as desired. An acquisition contract typically invokes many different MILSPECs and various technical documents such as drawings prepared by the Navy's Bureau of Ships. Taken together, the contract and the incorporated materials present all details of what the Navy requires. It is through this detailed acquisition process that misunderstanding, or rejection at the time of government acceptance inspection, is avoided. This process also minimizes contract disputes between the government and industry vendors.

30. Developing the contract design package is comparable to the effort required if a team was to simultaneously develop the detailed designs and contracts to construct a small city including all the required services such as utilities, hospitals, restaurants, and the like. Because of the complexity and thoroughness required, development of the contract design package for a warship such as a destroyer typically took two years or more to complete, with thousands of man-years or effort from engineers, logisticians,

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contract and legal specialists.

Detailed Design

31. From the 1940s through the 1970s,and even tosay, the next step in the creation of a new warship was the conversion of the contract design into detailed design package that contains sufficient details of the structure and all ships systems to allow the building shipyard to build the ship and integrate all specified equipment in accordance with Navy requirements and specifications. The detailed design was typically accomplished by the construction shipyard – whether a Navy yard or a private yard – after the construction contract was awarded. During this detailed design phase, engineers had to develop and document in detail the exact location, mounting details, and interface details of each system and piece of equipment in the total ship. Even where not performed by Navy personnel, the detailed design was also overseen by Navy representatives.

Warship Construction

32. The final phases in getting the warship operational included the construction, testing and trials, and acceptance by the Navy. During World War II and up until the mid-1960s, some Navy warships were constructed at Naval Shipyards and others were constructed at private shipyards under Navy contract and supervision. Once the Navy selected a construction shipyard, that shipyard was required to comply with all details of the contract in the procurement of material and equipment, the construction of the ship, the testing of equipment, subsystems, and systems and the demonstration to the government that all systems functioned properly. All construction and testing was overseen on a daily basis by the on-site Navy Supervisor of Shipbuilding team. Formal

acceptance of the completed warship was recommended by the Navy Board of Inspection and Survey only after the members of the Board had witnessed successful sea trials of all systems.

33. Construction of even a relatively small warship such as a destroyer typically took three to five years, with larger ships requiring somewhat longer. During World War II, the construction time for warships was dramatically reduced through the concerted efforts of both the Navy and the industries involved. The Navy, working with the War Production Board, instituted standardization of warship designs, central procurement of ships' major equipment, propulsion machinery, and ordnance, and allocation of key materials. Industry went to twenty-four hour workdays with multiple shifts, prefabrication and automation of many processes, and multiple other time saving methodologies. The Navy and the U.S. Maritime Commission worked closely with the shipbuilding industries and increased the number of shipyards capable of constructing destroyers and larger ships from approximately a dozen in 1940 to around 70 in about two years.

Asbestos and Insulation in the Navy

34. As described above, the Navy requirements for aircraft carriers and other warships of World War II and later included the need for significantly higher speeds than previously. This reqired high speed was achieved by the design and development of sophisticated high-pressure steam propulsion systems. Steam pressures of 600 pounds per square inch and the ability to superheat the steam to 850° F became the norm.

35. The key to meeting this high horsepower demand was the development by the Navy of much higher pressure, superheated steam propulsion plants. With the increased

pressures came greatly increased temperatures and thus the need for much improved insulation technologies, both for plant efficiency and for operator comfort and safety. These "high power density" propulsion plants increased the operating temperatures of machinery and piping, and they created a need for greatly improved thermal insulating and lagging materials. The Navy maintained significant expertise in the important areas of heat transfer and insulation. As a consequence, the thermal insulation needs associated with various equipment and systems was a significant issue in the design of Navy vessels from a number of perspectives. Thermal insulation served a number of important functions, as set forth, for example, by the 1947 version of the Navy's BUSHIPS Manual, a technical reference for Navy engineers, where Chapter 39 was devoted entirely to "Thermal Insulation":

> 39-2. REASONS FOR INSULATING
>
> (1) In every power plant there is a heat loss from all heated surfaces and a heat flow to all cooled surfaces. Heat flow may occur in three ways; by conduction, by convection, and by radiation.
>
> (2) Conduction is the heat flow from one part of a body to another part of the same body, or from one body to another with which it is in physical contact, without displacement of the particles of the body. This manner of heat flow is most important in insulation as it is the low conduction which results in the greatest temperature differential between a hot insulated surface and the atmosphere (as in steam piping insulation), or the relatively warm atmosphere and a cold surface (as in refrigerating plant insulation). Heat transfer from insulated pipes or large blanketed or cemented surfaces (turbines, evaporators, etc.) to the outer surface of their lagging is included in this mode. Conduction is associated with solids and comparison of materials in this respect is measured by a factor called the "thermal conductivity" which expresses rate of conductivity in British thermal units (B.t.u.) per inch of thickness per hour per square foot of area per degree Fahrenheit temperature differential.
>
> (3) Convection is the transfer of heat from one point to another within a fluid, gas or liquid, by circulating or mixing of one portion of the fluid with another. These currents are produced by warm fluid being displaced by heavier cold fluid. It is of interest to note that convection reduces the effectiveness of air

space insulation unless such space is very small.

(4) Radiation is the method of heat transfer by which a hot body gives off energy in the form of radiant heat which is emitted in all directions. Radiant heat, like light, travels in straight lines and with the speed of light. The surface condition greatly affects the ability of a body to radiate heat. Dull, dark, rough finished surfaces are the best radiators. Conversely, bright, shiny, smooth surfaces are good heat reflectors.

(5) In order to minimize the transfer of heat from or to a body or surface which is hotter or colder, respectively, than the surrounding atmosphere, thermal insulation is applied. This thermal insulation is a material or materials of low thermal conductivity. (See par. 39-2 (2).) While increasing the economy of the plant, thermal insulation also reduces the quantity of air necessary for ventilating and cooling requirements and prevents injury of personnel due to burns from contact with hot parts of apparatus. It also insures more uniform heat distribution within equipment. Another function of thermal insulation is to prevent "sweating" of cold surfaces on which atmospheric moisture condenses thus causing undesirable dripping as well as accelerated corrosion of the metal. Insulation must be sufficiently effective to reduce heat losses and lower surface temperatures to a degree which will permit habitable conditions in a specific space or compartment.

(Exhibit C, 39-2).

36. Due to the importance of heat transfer and insulation in Navy propulsion plants and aboard Navy vessels more generally, the Navy maintained significant expertise in these areas. The BUSHIPS manual and other documents issued and continuously updated by the Navy contained detailed instructions for the insulation by Navy shipyards or private contractors of various systems and equipment, including, primarily, the miles of piping associated with thermal systems aboard vessels. The Navy's specifications provided detailed instructions as to the specific insulating materials to be used, and also as to the amounts of those materials and the manner in which they were to be applied.

37. A 1946 article entitled "A Health Survey of Pipe Covering Operations in Constructing Naval Vessels" summarized the extent of and reasons for the Navy's use of asbestos-containing insulation during World War II:

> The chief reasons for the wide use of amosite felt and pipe covering in naval work are its low thermal conductivity, light weight, strength, and refractoriness. When the felt and pipe cover were first developed, we were still building vessels under the Washington Treaty of Limitations
> in Tonnage, and every pound saved meant that much more armor, guns or ammunition for a given displacement, to say nothing of more economic operation for the weight involved in insulation.
>
> Amosite pipe covering weighs about 14 pounds per cubic foot, with a temperature limit of 750 degrees F. as compared to magnesia with a weight of 16 pounds per cubic foot[. . . .]
>
> The development of amosite felt started in 1934 when a need existed to secure a thermal insulation lighter in weight and thermally more efficient than the materials (blocks and cement or asbestos blankets) which were then being used in destroyer turbines. . . . Originally amosite was used only for turbine insulation, but it proved so satisfactory that its field of application enlarged to include insulation of valves, fittings, flanges, etc. From the initial destroyer, it has been used on almost all the destroyers built since that time and on all other combat vessels built since before the War.
>
> Pipe covering was a later development in late 1935 and early 1936. Due to the manufacturing problems involved, it took a longer time to evolve into a satisfactory shape, and its first use on naval vessels was in 1937. Since that time its use has spread markedly and it was used on the great majority of naval combat vessels built during World War II.

(Exhibit D, p. 9).

38. The Navy's dictation of the methods and materials for insulation of thermal systems took various forms. As noted above, these included serial iterations of the BUSHIPS Manual's Chapter 39 on "Thermal Insulation." See Exhibits C (1947) and E (1960). The Navy also prepared and imposed upon Navy design engineers General Specifications for Machinery for Vessels of the United States Navy. Those specifications included an entire section – Section S39 – governing "Thermal Insulation for Machinery and Piping." The 1951 version of this document is attached as Exhibit F. Beginning in 1962, the Navy began issuing a Military Standard intended "to amplify the general requirements for insulation of piping, machinery, uptakes, and mechanical equipment

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covered in the General Specifications for Ships of the U.S. Navy or in ships specifications. (Exhibit G).

39. The Navy and/or its design agents prepared for the builders of Navy vessels detailed drawings and plans showing the precise methods and materials for insulation of various systems and equipment. Those documents – referred to as "Insulation and Lagging Schedules" – implemented the overall requirements of the General Speoifications, and they provided the actual instructions to the personnel applying insulation as part of an integrated system of temperature control and energy conservation consistent with the Navy's needs in the operation of its vessels. These "Insulation and Lagging Schedules" were typically developed for each class of warship. Examples of such plans for the *USS Fletcher* and *USS Sumner/Gearing* class destroyers and the *USS Essex*-class aircraft carriers are attached as Exhibits H, I and J. The Insulation and Lagging Schedules included details on the materials to be used, the thickness, installation procedures, and finishing details for tens or even hundreds of tons of thermal insulation materials to be applied by Navy and private shipyards. Once the Navy selected a construction shipyard, that shipyard was required to comply strictly with all Navy specifications, plans and drawings in the application of insulation and lagging to systems and equipment aboard Navy vessels.

40. As the attached documents demonstrate, throughout the World War II and post- World War II era, the vast majority of thermal insulating materials used aboard Navy vessels contained asbestos. Asbestos-containing materials offered many advantages over previous or alternative materials in meeting these needs. They were relatively light compared with previous materials, had better insuating properties, did not

require excessive thicknesses in application, were more durable and were resistant to dissolving in or absorbing salt water. The materials also served as fire protection in an environment in which fires were an ever-present danger.

41. Thus, the use of asbestos in thermal insulation allowed the Navy to design and field propulsion systems that met the demanding war fighting requirements of World War II and later. The importance of asbestos to Navy warships is attested to by the fact that it was assigned a high priority in the U.S. government's critical materials allocation process. Asbestos was in short supply during World War II, and its use was controlled through the War Production Board process. A very large percentage of asbestos was allocated to the needs of the Navy and U.S. Maritime Commission for use in insulation for ship construction.

42. The Navy's demands for asbestos-containing insulation were extraordinary. For example, the Insulation and Lagging schedules for destroyers of the Navy's *Sumner* and *Gearing* classes – relatively small vessels of which the Navy constructed approximately 200 during World War II – specified nearly 24 tons of asbestos containing thermal insulation be installed. A 1979 Department of the Navy letter (Exhibit K) recites the following estimates of the quantities of thermal insulation aboard different types of Navy vessels of the 1950s and 1960s:

Destroyer - DD	87,634 lbs
Guided Missile Cruiser - CGN	123,770 lbs
Submarine – SSN	62,465 lbs
Replenishment Oiler – AOR	78,515 lbs
Large Harbor Tug – YTB	6,858 lbs

Larger vessels, such as aircraft carriers and battleships – required multiples of those amounts. Taken as a whole, in both new construction and overhaul, the Navy applied

thousands of tons of asbestos materials aboard its vessels from the 1930s through the 1970s.

43. Due to the complexities of the ship design and construction process, and the global nature of the Navy's approach to selection and procurement of insulation and lagging materials, manufactuers of components such Buffalo Pumps were not consulted by the Navy with respect to insulation of their equipment. Moreover, they had no control over the types and quantities of insulation products to be used in conjunction with their equipment, nor could they even be certain whether or not any insulation would, in fact, be applied to their equipment due to the variety of circumstances and potential uses of the original equipment once aboard a Navy vessel.

44. Above and beyond the tens or hundreds of tons of thermal insulation used, other asbestos materials were ubiquitous aboard Navy vessels. These materials included electrical insulating materials, flooring, refractories and sealing materials.

Written Materials Regarding Equipment Supplied to the Navy

45. Technical specifications referenced in the procurement documents for components such as pumps have, since at least the 1940s, included detailed requirements regarding all written materials supplied with pumps. Manufacturerers were required to supply drawings and plans, as well as technical manuals for equipment. The applicable specifications included strict instructions regardng the labeling of and packaging of the components themselves, and for all technical documentation that was procured with them. Examples of MILSPECs for pumps during this period are attached as Exhibits A and B.

46. The Navy had precise specifications as to the nature of any markings,

communications or directions affixed to or made a part of any equipment supplied by manufacturers such as Buffalo Pumps for ultimate use aboard Navy ships. Such manufacturers would not have been permitted, under the specifications, associated regulations and procedures, nor under the actual practice as it evolved in the field, to vary or to deviate in any respect from the Navy specifications in supplying equipment, including affixing any type of warning or caution statement to equipment intended for installation in a Navy ship, beyond those specifically required by the Navy without prior discussion and expressed approval by the Navy.

47. The Navy also had precise specifications as to the nature of written materials to be delivered with equipment supplied to the Navy, which included engineering reference materials to assist the naval operators and maintanence personnel in servicing and maintaining such equipment and to assist the Navy training establishment to develop instructional materials and courses. These written materials are and were generically known as "instruction books" or "technical manuals." Through specifications, the Navy required that certain equipment be supplied with a defined number of copies of one or more instruction books or technical manuals.

48. Navy personnel participated intimately in the preparation and review of these instruction books and technical manuals in a standardized format used by the Navy. These manuals included safety information to the extent – and only to the extent – directed by the Navy. Manufacturers of components and equipment were not permitted, under the specifications, associated regulations and procedures, nor under the actual practice as it evolved in the field, to include any type of warning or caution statement in instruction books or technical manuals, beyond those required and approved by the Navy

Case 4:19-cv-00526-DMR Document 1-1 Filed 01/18/19 Page 104 of 354

without prior discussion and approval by the Navy. The Navy dictated, reviewed and approved the contents of all technical manuals, including any cautionary language or emphasis. The Navy approached this process for review and approval of technical manuals in an exacting manner. It often created lengthy memoranda detailing word-by-word line edits to the content of technical manuals submitted for approval, including the wording of instructional material and warnings. Examples of such correspondence are attached as Exhibit L.

49. The reasons for the Navy's detailed control over and review and approval of all written communication regarding equipment it procured was to ensure consistency of that information with the overall goals and priorities of the Navy in its operations. The Navy employed millions of uniformed and civilian personnel aboard thousands of vessels and at hundreds of land-based facilities around the world. The information provided with regard to equipment had to be consistent with the Navy's overall evaluation of the appropriate types and level of information its personnel required to efficiently perform their job responsibilities under a variety of circumstances. In addition, written communications regarding work practices, including safety precautions and equipment, had to be coordinated with the training of Navy personnel, the physical circumstances in which they performed their work, and the tools, protective devices and equipment and other materials available aboard Navy vessels and at Navy installations.

50. Based upon my knowledge of and experience in the design, inspection and procurement of components for use on Navy vessels, the Navy would not have permitted Buffalo Pumps or other equipment manufactuers to place asbestos-related warnings in technical manuals supplied with pumps for Navy ships during the 1940s, 1950s and

1960s.

Navy Organization

51. Consistent with the sweeping scope of its mission and responsibilities, the Navy is comprised of many different organizations, each of which is specialized in focus, talent and experience. These organizations work together in accomplishing the very complex and unique sequential efforts from the defining of naval war fighting requirements, to designing ships and weapon systems that will meet these requirements, and then contracting with industry and other government agencies to procure the vast array of required equipment and materials and to construct and test warships. This diverse Navy organization can be described in four major groupings:

-- Secretary of the Navy (SECNAV) and the Chief of Naval Operations (CNO) headquarters staffs (CNO staff is referred to as OPNAV)
-- Operational Fleets
-- Technical Bureaus (now called Systems Commands)
-- Staff Corps (Medical, Dental, Legal, etc.)

SECNAV and CNO Staffs

52. The staffs of Secretary of the Navy (SECNAV) and the Chief of Naval Operations (CNO) are involved in the analysis of national naval war fighting needs, and the development of specific war fighting requirements that must be met. At a top level for warships, these requirements include such things as the types and numbers of ships needed; the capabilities for these ships such as speed, weapons to be installed; types and numbers of aircraft to be embarked; the range and duration at which these ships must be able to operate independently at sea without replenishment; and the reliability of systems that must be guaranteed in order for the Navy to meets its war fighting mission. These staffs are manned by a combination of experienced uniformed Navy personnel with

extensive Fleet experience and career civil servants.

Operational Fleets

53. The Operational Fleets are the Navy's war fighters who control and operate the various ships, aircraft, and other equipment in the Navy and Marine Corps. There are several numbered Fleets (*e.g.*, Sixth Fleet, Seventh Fleet) with regional geographic responsibilities around the world. These Operational Fleets have always worked closely with the headquarters staffs in the development of naval warship required capabilities.

Technical Bureaus

54. The Bureau System was established in 1842 to provide the Navy with necessary technical and management control. By the early 1940s, there were six bureaus:

-- Bureau of Naval Yards and Docks
-- Bureau of Ships (BUSHIPS)
-- Bureau of Supplies and Accounts (BUSANDA)
-- Bureau of Ordnance and Hydrography
-- Bureau of Medicine and Surgery
-- Bureau of Aeronautics

In the 1950s, a Bureau of Weapons (BUWEPS) was formed by merging the Bureau of Ordnance and the Bureau of Aeronautics. In the 1960s the bureau system evolved into what are now called the Systems Commands where BUWEPS became the Naval Air Systems Command, BUSHIPS became the Naval Sea Systems Command (NAVSEA), and BUSANDA became the Naval Supply Systems Command.

Navy Staff Corps

55. The various staff corps of the Navy are comprised of professionals such as doctors, dentists, and lawyers who support all aspects of the Navy in their respective specialties.

56. The Bureau of Medicine (BUMED) has always had a very significant role in

Case 1:10-cv-08819-TPG Document 1-5 Filed 11/22/10 Page 38 of 56

both the design and operation of Navy warships, in addition to its fundamental role in the overall health and well-being of Navy personnel. All ships have medical facilities integrated into the design, both for normal medical support of the large crews, and for treatment of battle injuries. Small ships such as destroyers have a modest infirmary space and other spaces that can be converted for medical use while at battle stations. Larger ships have much greater medical capability, with aircraft carriers being fully equipped with several operating rooms for surgery and large hospital wards for sick and wounded personnel.

57. BUMED also plays a very significant role in the operation of Navy ships. BUMED establishes the medical policies and procedures, both preventive and curative, which are utilized on all Navy warships. Additionally, the crew of each warship includes medical personnel who are involved in preventive medicine, crew training, health inspections, and treatment of ailments and injuries. Small ships such as destroyers typically have one highly trained enlisted hospital corpsman assigned, and large ships have both physicians and hospital corpsmen. Aircraft carriers have numerous medical doctors and surgeons with various specialties.

Responsibilities in Warship Design and Construction

58. Responsibilities for the various functions associated with warship design and construction in from the World War II period to the 1970s were as follows:

SECNAV and OPNAV Staffs

59. Working closely with the Operational Fleets and Bureaus, these staffs had the responsibility for defining naval war fighting requirements, developing concepts of operations and ship concepts, and requesting congressional authority and funding to build

war ships.

BUSHIPS

60. The Bureau of Ships was comprised of a broad assortment of engineers and technical personnel, and was responsible for all technical aspects of Navy warships. Included were the preliminary designs of ships, the detailed design of equipment and subsystems, and development of the contract design package. BUSHIPS, aided by BUSANDA, had the responsibility to develop the contract design package and the myriad invitation for bids required to actually procure and construct the ships. All U.S. Naval Shipyards were under the direct command of BUSHIPS, as were the resident Supervisors of Shipbuilding who performed the same government supervisory functions at civilian shipyards. Thus, BUSHIPS was responsible for both the new construction and future repair and overhaul of ships at both naval and private shipyards. BUSHIPS and BUSANDA each had on-site Navy inspectors at various vendors' plants that were responsible for verifying that the vendor complied exactly with all provisions of that vendor's procurement contracts. BUSHIPS was also responsible for the design and development of equipment repair and maintenance standards and procedures, and for the development of Navy Specs/MILSPECs that related to ships and ship equipment.

BUSANDA

61. The Bureau of Supplies and Accounts was comprised of a variety of professionals with specialties in areas such as government contracting, logistics planning, financial and business management, warehousing and parts distribution management, etc. BUSANDA, in addition to on-site and continuous support of BUSHIPS and other technical bureaus, also provided all Supply Corps officers to the Operational Fleet. The

Supply Corps officers were assigned to both ships and Fleet staffs and were responsible for planning and managing all shipboard messing, berthing and spare parts management. BUSANDA was responsible for maintaining and managing the vast inventory of spare parts, consumables, documentation, and replacement equipment for the Navy.

David P. Sargent, Jr.

Sworn to and subscribed before me this 5 th day of March, 2008.

NOTARY PUBLIC
EVELYN B. STARKEY

NOTARY PUBLIC STATE OF W.V.

MY COMMISSION EXPIRES: 12/29/2010

PORTSMOUTH NAVAL SHIPYARD
PORTSMOUTH, N. H.

IN REPLY REFER TO
245P
N102-58684(X)
(7/1)

JUN 8 1959

From: Commander, Portsmouth Naval Shipyard
To: Chief, Bureau of Ships

Subj: SS(N)593 Class Submarines, Technical Manual for Low Pressure Brine Pump for 8000 GPD Distillation Unit; forwarding preliminary copies for approval and assignment of NAVSHIPS number

Ref: (a) PTSMH NAVSHIPYD Contract N102-58684(X) with Warren Pumps Inc Warren Mass
(b) Detail Specs for Building Submarine SS(N)593
(c) Military Spec MIL-M-15071C (Ships) of 10 Sep 1957

Encl: (1) Preliminary copy of Technical Manual, Low Pressure Brine Pump for 8000 GPD Distillation Unit, PTSMH No. B-9884 (2 copies)

1. Subject preliminary technical manual has been prepared under reference (a). As required by references (b) and (c), copies are forwarded for Bureau approval and assignment of a NAVSHIPS identification number. Approval is recommended subject to the following comments:

a. Cover and Title Page: After "Low Pressure Brine Pump", add "for 8000 GPD distillation unit."

b. Approval and Procurement Record Page: the approved style of APR page as outlined in reference (c) shall be used in the final manuals.

c. Table of Contents: Add ahead of listing "Part I Low Pressure Brine Pump", below listing of Part I add "Part II Electrical Motor."

d. Page 1:

(1) Line 1; after "description" add word "installation".

(2) Line 2; type "1 1/2-CVCC-5" is proper designation.

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N102-58884(X)
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(3) Line 3; after "suction," change to read "semi-open impeller, close-coupled type."

(4) CAUTION note (bottom of page); second sentence should read "It is not to be dropped or jarred and should always be transported with the pump unit supported on resilient mounts or, if rigidly supported on the distillation unit, the entire assembly should be supported on resilient mounts during shipping."

e. Page 3:

(1) Alignment; delete this paragraph.

(2) Check for Alignment; delete line 5 and substitute "aligned and balanced."

(3) Trouble Shooting Guide;

Low capacity - strike out causes "9, 10 and 29"
Low pressure developed - strike out cause "29"
Excessive power required - strike out cause "29"
Excessive leakage from stuffing box - strike out cause "22"

f. Pages 4 and 5: Lists of troubles; delete items 9, 10, 22, 29, 42, 44, 45 and 46.

g. Page 5: Mechanical Troubles; item 41 delete words "or failure of a hydraulic balancing device, causes excessive thrust." Comment: There is no hydraulic balancing device.

h. Page 5: Dismantling; paragraph 5, after "removing bolts (20) add ", loosening Piece (18),"

i. Page 6: Reassembling;

(1) Paragraph 5, after "Washers (30)" should read "on studs (13) and (14)."

(2) Paragraph 8, should read "on studs (13) and (14)."

(3) Paragraph 10, delete ". . .bolt together with bolts." and substitute "and secure with screws (20)".

(4) Paragraph 11, delete "along with the resilient mounts."

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[redacted]

245P
N102-68884(X)
(7/1)

2. To meet scheduled dates, Bureau approval is requested within three weeks. Final printed copies will be distributed in accordance with reference (b) approximately 120 days after receipt of Bureau approval. Twenty-five copies of the manual will be forwarded to Ships Parts Control Center, Mechanicsburg, Pa., for stock.

J. WOOLSTON
BY DIRECTION

Copy to:
BUSHIPS (Code 525)
MARE NAVSHIPYD (w/2 copies encl (1))

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B

PORTSMOUTH NAVAL SHIPYARD
PORTSMOUTH N. H.

IN REPLY REFER TO
245P
N102-68648(X)
(7/1)

JUN 8 1959

From: Commander, Portsmouth Naval Shipyard
To: Chief, Bureau of Ships

Subj: SS(N)593 Class Submarines; Technical Manual for Type 31K De Laval - IMO Pump, forwarding preliminary copies for approval and assignment of NAVSHIPS No.

Ref: (a) PTSMH NAVSHIPYD Contract N102-68648(X) with De Laval Steam Turbine Co Trenton N J
(b) Detail Specs for Building Submarine SS(N)593
(c) Military Spec MIL-M-15071C (Ships) of 10 Sep 1957

Encl: (1) Preliminary Copy of Technical Manual Type 31K De Laval - IMO Pump, PTSMH No. B-9901 (2 copies)

1. Subject preliminary technical manual has been prepared under reference (a). As required by references (b) and (c), copies are forwarded for Bureau approval and assignment of a NAVSHIPS identification number. Approval is recommended subject to the following comments:

a. Complete approval and procurement record page.

b. Pages 1-1; 1-1-1 Introduction - Second paragraph should begin: "Each unit consists of a pump and motor, flexibly coupled, complete with mounting brackets. All pumps are identical. Motor drives are 100 HP or 50 HP. Arrangement of the 50 HP units, etc."

2. To meet scheduled dates, Bureau approval is requested within three weeks. Final printed copies will be distributed in accordance with reference (b) approximately 120 days after receipt of Bureau approval. Twenty-five copies of the manual will be forwarded to Ships Parts Control Center, Mechanicsburg, Pa., for stock.

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SS(N)593 Class/547

J. WOOLSTON
BY DIRECTION

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USS Haddock
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PORTSMOUTH N. A. SHIPYARD

SS(N)593 01/S47(649P)
Ser 649P-R88

From: Chief, Bureau of Ships
To: Commander, Portsmouth Naval Shipyard
Portsmouth, New Hampshire

29 JUN 1959

Subj: Contract N102-68884(X) - SS(N)593, Low Pressure Brine Pump for 8000 GPD Distillation Unit - Preliminary Manual for Approval

Ref: (a) NAVSHIPYD PTSMH ltr 245P N102-68884(X)(7/1) of 8 June 1959
(b) Warren Pumps, Incorporated, technical manual, Low Pressure Brine Pumps - NAVSHIPS 347-3378

1. Preliminary technical manual, reference (b), was forwarded to the Bureau for approval and assignment of NAVSHIPS number by reference (a).

2. Reference (b) has been assigned the NAVSHIPS number appearing above and is approved subject to conformance with the comments contained in reference (a) and additional comments as follows:

a. On page 1 of the text, under paragraph headed "General Data", delete the present paragraph in its entirety and insert "the complete pump and motor characteristics, the Table of Weights, clearances, List of Reference Drawings, List of Onboard Repair Parts, and any other pertinent data". This data should be listed in tabular form as required by paragraph 3.3.1.2.1 of Specification MIL-M-15071C".

3. All drawings and illustrations contained in the text shall be total reproductions of final approved and validated drawings.

4. This letter in no way authorizes any increase in the cost of the subject equipment being procured under the subject contract, or approval of any changes in commitments or delivery schedule.

Copy to:
525
1500L Attn: Mr. Kooyman
626B4

WILLIAM A. BUDDING, JR.
By direction

Prepared by A. Napoletano, Ext. 62217
Typed by Marilyn Janda, 6-24-59
6111062

USS Haddock
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SS(X)59301/9417(66684)
Ser 6668-3363

From: Chief, Bureau of Ships
To: Commander, Portsmouth Naval Shipyard

13 JUL 1959

Subj: [illegible] (SS593) class, IMO hydraulic pump, type 31K 156; approval of technical manual for

Ref: (a) PORTSNAVSHIPYD ltr 245P, X102-68648(x) (7/L) of 8 June 1959

1. NAVSHIPS number 347-3377 is assigned to the technical manual forwarded by reference (a) for subject equipment manufactured by De Laval Steam Turbine Company.

2. The subject manual is hereby approved by the Bureau subject to the following comments, in addition to the Shipyard comments:

a. Sample Cover, delete title "Type 31K De Laval-IMO Pump" substitute "IMO PUMP for MAIN and VITAL HYDRAULIC SYSTEMS"

b. Sample Approval page, delete title, "Type 31K De Laval-IMO PUMP" substitute "IMO PUMP for MAIN and VITAL HYDRAULIC SYSTEMS"

c. Page 1-1, Section 1-1-1 Introduction, after first paragraph, add a note "The terms fluid and oil are used synonymously and both refer to the power transmission liquid in the hydraulic system"

d. Page 1-1, Section 1-1-2, (1) Fluid Operating Temperature Range, °F, delete "70-120" substitute "70-160" (2) Fluid Viscosity Range, SSU, delete "270-1000" substitute "180-1600"

e. Page 1-2 Section 2 Unit Drawings also Page 1-3/4, Page 1-5/6, The title of the drawings, "Outline, Certification Data, List of On-Board Repair Parts, Tools and Characteristic Curves" does not reflect content of the drawings since the list of on-board repair parts, tools and characteristic curves are not shown. Either the title of the drawings should be revised or the missing data filled in.

f. Page 5-1, Section 5-1-1 General, line 2, "oil soluble" rust preventative is not applicable since the system is designed to use phosphate ester hydraulic fluid.

Copy to:
COMMANDER [illegible]
SUPSHIP PASCAGOULA

R. L. [illegible]
[illegible]

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Prepared by F.L. McIntosh Ext. 65455

PORTSMOUTH NAVAL SHIPYARD
PORTSMOUTH, N. H.

245F
NI02-68605(X)
(8/26)

JAN - 7 1959

From: Commander, Portsmouth Naval Shipyard
To: Nash Engineering Co., South Norwalk, Conn.

Subj: SS(N)593 Class Submarines; Technical Manual for Hytor Vacuum Priming Pump for Trim and Drain Pump, NAVSHIPS 347-3374, approval of

Ref: (a) Contract NI02-68605(X) Item 3 Technical Manuals
(b) Nash Engineering Co ltr of 17 Dec 1958
(c) Military Spec MIL-M-15071C (Ships) of 10 Sep 1957

1. The subject technical manual, prepared under reference (a) and submitted for approval by reference (b), is approved subject to the following comments:

a. Figure 1-1 should be of current design showing new seal water tank of Nash drawing AA-626.

b. Include drawing AA-626, Seal Water Tank, with drawings.

c. Complete the Approval and Procurement Record Page.

d. Make corrections to drawings in accordance with Portsmouth Naval Shipyard letter 2544 NI02-68605(X) of 13 December 1958 with exception noted in Portsmouth Naval Shipyard speedletter of 18 December 1958.

e. Pages 1-4, 1st paragraph, 12th sentence - "orifice bushing (26)" should be "orifice bushing (16)". Also 13th sentence "(16)" instead "(26)". 17th sentence - "fitting (30)" should be "elbow (31)" and "pipe (21)" should be "pipe (22)".

f. Pages 1-6, 3rd paragraph, 6th line - after "vacuum" insert "during operation". 3rd paragraph, 7th line - after "packing" insert "while primer is not operating". 4th paragraph, last line delete phrase in parentheses (Details under Repairs, etc.). Subtitle beginning with "Primer" - after word "Volume" add "of Air".

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USS Haddock
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NI02-68605(X)
(8/26)

g. Pages 1-7 part (b), 2nd line replace semicolon after "bushing" with comma. 3rd line after "centrifugal" add "pump". Part d - delete "comma" and the words "not open".

h. Pages 1-7, Title line "Water Out Air Discharge" - add "Pipe". Next paragraph, 1st line, delete "over", insert "out with air".

i. Pages 1-7, Title line "Repairs" reword directions to "Refer to Figures 1-6 and 1-7 for List of On Board Repair Parts."

j. Pages 1-7, Title line "Dismantling" add "Pump Only". 6th paragraph line 5 - delete words "two of" and put semicolon after (2) line 6. Delete words "The remaining two" and insert words "and the tapered". Line 7 - delete words "are tapered and" and insert "which".

k. Pages 1-8, 1st line (a) - after "studs" delete "(22)" and insert "(21)". Subsection (g), line 1 - after word "studs" change "(21)" to "(22)". Subsection (g), line 6 - change word "Point" to "Paragraph".

l. Pages 1-10, 2nd paragraph line 1 - after "cone" insert "(2)". Subsect (b), line 1 - after "studs" change "21" to "22". Add subsect "(g) Tighten all nuts evenly."

m. Pages 1-13, 4th paragraph - after word "drilling" add "If there is no rubbing, tighten nuts (26) on studs (21) evenly and then drill for dowels."

n. Page iv Table of Contents and List of Illustrations, delete Chapter II - Electrical Motor; also, delete Chapter I headings. Motor Information shall not be bound into the manual. Instead, staple each motor insert in its upper left corner and slip the unbound inserts packaged with the pump manuals.

2. Provision of reference (c) require that final manuals be delivered to this Shipyard within ninety days of receipt of this approval. Information is requested as to the anticipated shipping date.

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N102-68605(X)
(8/26)

3. You are requested to comply with the requirements of paragraph 3.4.4.9 of reference (c) and forward a reproducible copy of subject manual directly to Naval Supply Depot, Mechanicsburg, Pennsylvania. Please make reference to the Contract and NAVSHIPS numbers when forwarding reproducible copy of the manual. Also, please forward copy of transmittal to Portsmouth Naval Shipyard, Portsmouth, New Hampshire, attention Code 245P.

4. This letter in no way authorizes any changes in the conditions, funds, or extension of delivery times beyond those stated in the contract. If the contractor believes a change is necessary or that additional time or funds are required because of the above authorization or approval, he must so state immediately in reply to this letter and receive authorization from the Contracting Officer before proceeding.

J. WOOLSTON
BY DIRECTION

Copy to:
BUSHIPS (525)(3)
INSMAT Bridgeport (2)
SPCC MECH

8101116-59

USS Haddock

PORTSMOUTH NAVAL SHIPYARD
PORTSMOUTH, N. H.

IN REPLY REFER TO

SIS

245P
N102-68643(X)
(9/3)

AUG 13 1959

From: Commander, Portsmouth Naval Shipyard
To: Chief, Bureau of Ships

Subj: SS(N)593 Class Submarines; Technical Manual for Low Pressure Brine Pump for 2000 GPD Still, forwarding preliminary copies for comment and assignment of NAVSHIPS number

Ref: (a) PTSMH NAVSHIPYD Contract N102-68643(X) with Warren Pumps Inc Warren Mass
(b) Detail Specs for Building Submarine SS(N)593
(c) Military Spec MIL-M-15071c (Ships) of 10-Sep 1957

Encl: (1) Preliminary copy of Technical Manual, Low Pressure Brine Pump for 2000 GPD Still, PTSMH No. B-9885 (2 copies)

1. Subject preliminary technical manual has been prepared under reference (a). As required by references (b) and (c), copies are forwarded for Bureau comment and assignment of a NAVSHIPS identification number. Approval will be granted subject to the following comments:

a. Approval and Procurement Record Page - The approved style of APR page shall be used in the final manual.

b. Page 1, Introduction: Line 1 after "operation" add "installation"; line 2, substitute "3/4-GVOC-4" for "1-1/4-GVOC-5"; line 3, substitute "semi-open" for "open".

c. Page 1, Detailed Description: Paragraph 3, line 4, substitute "drilled" for "tapped"; "Caution" Note, last sentence should read - "It is not to be dropped or jarred and should always be supported on the resilient mounts."

d. Page 3 Alignment: Delete this paragraph.

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e. Page 3, Check for Alignment: Delete last line in paragraph and substitute "aligned and balanced."

SS(N)593 class/547

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N102-68643(X)
(9/3)

f. Page 4: Delete "Troubles No. 9, 10, 22, 29.

g. Page 5: Delete Trouble No. 41.

h. Page 5 Dismantling: Paragraph 5, substitute "screws (20)" for "bolts (20)."

i. Page 6 Reassembling: Paragraph 8 add "and (14)"; paragraph 10 delete "and bolt together with bolts (20)".

2. To meet scheduled dates, Bureau approval is requested within three weeks. Final printed copies will be distributed in accordance with reference (b) approximately 120 days after receipt of Bureau approval. Twenty-five copies of the manual will be forwarded to Ships Parts Control Center, Mechanicsburg for stock.

J. Woolston

J. WOOLSTON
BY DIRECTION

Copy to:
BUSHIPS. (Code 525) (3)
MARE-NAVSHIPYD (2-copies encl (1))

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USS Haddock
020

NP(N)59301/S57(649P)
Ser 649P-E436

From: Chief, Bureau of Ships
To: Commander
Portsmouth Naval Shipyard
Portsmouth, New Hampshire

17 SEP 1959

Subj: Contract NObs-68643(X) with Warren Pumps, Incorporated, SS(N)593 Class Submarines - 2000 GPD Distilling Unit Low Pressure Brine Pump - Preliminary Technical Manual for Approval

Ref: (a) NAVSHIPYD Portsmouth ltr 245P, NObs-68643(X), (9/4) of 13 August 1959
(b) Warren Pumps, Incorporated Preliminary Technical Manual - 2000 GPD Distilling Unit L. P. Brine Pump - NAVSHIPS 347-3456

1. Preliminary technical manual, reference (b), was forwarded to the Bureau of Ships for approval and assignment of a NAVSHIPS number by reference (a).

2. Reference (b) has been assigned the NAVSHIPS number appearing above and is approved subject to conformance with the comments contained in reference (a) and additional comments as follows:

a. On page 1 of the text, under paragraph headed "General Data", delete the present paragraph in its entirety and insert the complete pump and motor characteristics, the Table of Weights, Clearances, List of Reference Drawings, List of Onboard Repair Parts and other pertinent data. This data shall be listed in tabular form as required by paragraph 3.3.1.2.1 of Specification, MIL-P-15071C.

3. All drawings and illustrations contained in the text shall be total reproductions of final approved and validated drawings.

4. This letter in no way authorizes any increase in the cost of the subject equipment being produced under the subject contract, or approval of any changes in commitments or delivery schedule.

Copy to:
622B
626B4
525
622.3

Prepared by A. Napoletano, Ext. 62217
Typed by Marilyn Janda, 9-17-59
8200727-59

C. C. PETERSON

PORTSMOUTH NAVAL SHIPYARD
PORTSMOUTH, N. H.

DAW

IN REPLY REFER TO
245E
N102-68895
(10/8)

SEP 21 1959

From: Commander, Portsmouth Naval Shipyard
To: Chief, Bureau of Ships

Subj: SS(N)593 Class submarines; technical manuals for air conditioning sea water pump (lithium bromide plant), forwarding preliminary copies for comment and assignment of NAVSHIPS number

Ref: (a) PTSMH NAVSHIPYD Contract N102-68895 with Worthington Corporation Harrison N J
(b) Detail Specs for Building Submarine SS(N)593 Section S1-5C
(c) Military Specs MIL-M-15071C (SHIPS) of 10 Sep 1957

Encl: (1) Preliminary copy of Technical Manual, Air Conditioning Sea Water Pump (Lithium Bromide Plant), PTSMH No. 8-9920--2 copies

1. Subject preliminary technical manual has been prepared under reference (a). As required under references (b) and (c), copies are forwarded for Bureau comment and assignment of a NAVSHIPS identification number. Approval is to be granted subject to the following comments:

(a) Cover - Add information shown on Figure 1 of reference (c).

(b) Title page - Add information as shown on Figure 2 of reference (c).

(c) Section 1, page 1-1-1, paragraph 1-1-4 - Fill in weights for pump spare parts and motor spare parts.

(d) Section 1, page 1-1-2, paragraph 1-1-5, line 3 - After "and shaft", add "sleeve."

(e) Section 1, page 1-1-2, paragraph 1-1-7 - Add motor serial numbers when available.

(f) Section 2, page 2-12, paragraph 2-4-(7)-(7) - Add "Jacking screws are provided."

2. To meet scheduled dates, Bureau approval is requested within three weeks. Final printed copies will be distributed in accordance with reference (b) approximately 120 days after receipt of Bureau approval. Twenty-five (25) copies of the manual will be forwarded to Ships Parts Control Center, Mechanicsburg, Penna, for stock.

624 SS(N) 593 class / 847

9240341-59

J. WOOLSTON
BY DIRECTION

Copy to:
BUSHIPS (Code 525)

USS Haddock
908

PORTSMOUTH NAVAL SHIPYARD
PORTSMOUTH, N. H.

IN REPLY REFER TO

NGB

245P
N102-68467(10/16)

SEP 23 1958

From: Commander, Portsmouth Naval Shipyard
To: Chief, Bureau of Ships

Subj: SS(N)593 Class Submarines; Technical Manual for Auxiliary Sea Water Service Pump, forwarding ~~preliminary copies for comment and assignment~~ of NAVSHIPS No.

Ref: (a) PTSMH NAVSHIPYD Contract N102-68467 with Ingersoll-Rand Co New York 4 N Y
(b) Detail Specs for Building Submarine SS(N)593 Section S1-5-C
(c) Military Spec MIL-M-15071C (Ships) of 10 Sep 1957

Encl: (1) Preliminary copy of Technical Manual, Auxiliary Sea Water Service Pump, PTSMH No. B-9896 -- 2 copies

1. Subject preliminary technical manual has been prepared under reference (a). As required under references (b) and (c), copies are forwarded for Bureau comment and assignment of a NAVSHIPS identification number. Approval will be granted subject to the following comments:

a. Furnish an Approval and Procurement Record page completely filled out in accordance with reference (c).

b. Page 1-1-1, under General Data:

Temperature - after "30-85" add "degrees F"
Total Head - delete "H_2O", substitute "water"
Pump - before "58A" add "Type"

c. Page 1-1-2, Paragraph 4, line 1, after "pump" insert "impeller (3)"; lines 1 and 2, delete "of the single suction enclosed type", line 2, delete "on" and substitute "one"; paragraph 5, line 2, delete "sleeve (8)" and substitute "sleeves, (8A) and (8B)"; paragraph 8, line 1 delete "flange on" and substitute "face of"; paragraph 8, line 7, after "gland" add "(17A)"; paragraph 8, line 9, after "sleeve" delete "(8)" and substitute "(8A)" paragraph 8, line 13, after "bearing" add "(24)"; paragraph 8, line 14, after "lockwashers" delete "(241A)" and substitute "(241B)".

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SS(N)593 Class/S49

W

Encl

23

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245P
N102-68467(10/16)

d. Page 1-3-1, Section 1-3-2, line 1, after "units," add "for the first time."

e. Page 1-4-1, second paragraph; line 2, delete "continuously" and substitute "frequently"; line 3, delete "operations" and substitute "operation"; under Section 1-4-2, step 1, the term "smothering gland connection" is not clearly understood, believe "gland bleed off" or "cooling water connection" is intended; step 2, delete "(See Chapter 2)."

f. Page 1-4-2, Section 1-4-2, Step 12; line 2, delete "(246B)" and substitute "(241D)".

g. Page 1-4-3, Step 7; line 4, delete "(246B); and substitute "(241D)".

h. Page 1-4-4, Step 19; clarify term "smothering".

2. To meet scheduled dates, Bureau approval is requested within three weeks. Final printed copies will be distributed in accordance with reference (b) approximately 120 days after receipt of Bureau approval. Twenty-five copies of the manual will be forwarded to Ships Parts Control Center, Mechanicsburg for stock.

C. H. WOOLSTON
BY DIRECTION

Copy to:
BUSHIPS (Code 525)
MARE.NAVSHIPYD (w/2 copies encl (1))

9280518-59

ENCLOSURES RECEIVED IN 233

USS Haddock
013

Case 4:19-cv-00526-DMR Document 1-1 Filed 01/18/19 Page 125 of 354

[illegible]
Ser [illegible]

From: Chief, Bureau of Ships
To: Commander
Portsmouth Naval Shipyard
Portsmouth, New Hampshire

13 OCT 1959

Subj: [illegible]

Ref: (a) [illegible]
(b) [illegible] Preliminary Technical Manual [illegible]

1. Preliminary technical manual, reference (b), was forwarded to the Bureau for comment and assignment of a NAVSHIPS number by reference (a).

2. Reference (b) has been assigned the NAVSHIPS number [illegible] and approval is recommended for the subject [illegible] upon compliance with the comments contained in reference (a) and additional comments as follows:

a. On page 1-1-1, under column headed "General Data", add the "List of Applicable Drawings".

b. All drawings and illustrations contained in the text shall be total reproductions of final approved and validated drawings.

3. This letter in no way authorizes any increase in the cost of the subject equipment being procured under the subject contract(s) or approval of any changes in commitments or delivery schedule.

WILLIAM A. BUDDING, JR.
By direction

Copy to:
626B4
622B1
622B3
525
1500L (Kooyman)

USS Haddock
828

Case 4:19-cv-00326-DMR Document 1-1 Filed 01/18/19 Page 126 of 354

Affidavit of Martin K. Kraft

EXHIBIT 3

TO DECLARATION
OF REAR ADMIRAL BEN J. LEHMAN (RET.)

Case 4:19-cv-00326-DMR Document 1-1 Filed 01/18/19 Page 127 of 334

William A. O'Connell v. Buffalo Pumps, Inc. et al.,
Civil Action 1:08-cv-10078-RGS,
United States District Court, District of Massachusetts

AFFIDAVIT OF MARTIN K. KRAFT

STATE OF NEW YORK)
) SS.
COUNTY OF NIAGARA)

I, Martin K. Kraft, being under penalty of perjury, declare and say:

1. I began my career with the Buffalo Pumps Division of Buffalo Forge Company in 1980. I have held various positions with the Buffalo Pumps Division of Buffalo Forge Company, and, beginning in 1985, with Buffalo Pumps, Inc. I currently am the Production Manager.

2. I am knowledgeable regarding the United States Navy ("Navy")'s involvement in and control over the design and manufacture of pumps it purchased from Buffalo Pumps, Inc. and the Buffalo Pumps Division of the Buffalo Forge Company (collectively, "Buffalo Pumps") because I have participated in the design, manufacture, and testing of these pumps. I also have conducted a review of available documents and information regarding similar matters prior to my employment with Buffalo Pumps.

3. Buffalo Pumps has for years made and supplied pumps for Navy ships under contracts between Buffalo Pumps and the shipyards and/or the United States of America, specifically the Navy Department.

4. At all relevant times, a Defense Contract Administration Services Management Area ("DCAS") inspector was assigned to be present at Buffalo Pumps' manufacturing facility in North Tonawanda, New York. The inspector was responsible for conducting process

surveillance to assure compliance of work being done pursuant to Navy contracts. The DCAS inspector examined pumps at various phases of construction and at "hold points" specified in the contract to determine whether Buffalo Pumps' work complied with the contract and applicable specifications. The inspector had the authority to reject production of a particular pump at any point if its construction deviated from specified design, material and performance requirements. Additionally, the inspector observed testing of pumps and provided final acceptance of pumps for shipment to the Navy when specified.

5. The manufacture of pumps for use on Navy vessels is governed by an extensive set of general and specific federal standards and specifications, chiefly military specifications known as "MilSpecs." The MilSpecs governed all aspects of a pump's design and construction and specified the materials to be used, including materials such as gaskets and packing used in pumps. Among the most commonly-applicable MilSpecs for Navy pumps manufactured by Buffalo Pumps have been Mil-P-17639 ("Pumps, Centrifugal, Miscellaneous Service, for Use on Naval Ships") (attached as Exhibit A) and Mil-P-17840 ("Pumps, Centrifugal, Close-Coupled, Navy Standard") (attached as Exhibit B), and their predecessors and successors.

6. As can be seen from the attached Mil Specs, the Navy issued specifications governing numerous aspects of the pump design and manufacture, including the designation of materials to be used in construction. Among numerous other requirements, the specifications state that "[p]ump casing joints shall be made up using compressed asbestos sheet gaskets." (Exhibit A, at 3.4.1.5; Exhibit B, at 3.26).

7. The initial conceptual design for pumps on all classes of Navy vessel was developed under the direction of BUSHIPS, and later NAVSEA. When Buffalo Pumps began to participate

Case 4:19-cv-00326-DMR Document 1-1 Filed 01/18/19 Page 129 of 334

in the design phase of a new pump, the Navy provided performance requirements dictating the weight, size, power output, speed, and other relevant design parameters of the pump.

8. In the design phase of the pump project, as in all other phases, the Navy retained ultimate decision authority over the design of the pumps. If engineering disagreements arose between the Navy and an outside design consultant, the Navy controlled the design adopted. All pumps supplied by Buffalo Pumps to the Navy were built in accordance with the Navy specifications or other technical documentation identified in applicable contract documents.

9. Not only did pumps manufactured and supplied by Buffalo Pumps for Navy vessels have to meet detailed and precise Navy specifications, but each pump's configuration was controlled by the Navy's specified performance requirements for the vessel or class of vessels in question. In other words, the pumps for a vessel or class of vessels were engineered for a specific application and were custom-built.

10. Equipment designed and supplied for the Navy usually was not "off the shelf" product. Pumps built for use on Navy ships were subject to different and much stricter design, manufacturing and performance standards than pumps that Buffalo Pumps manufactured and marketed for commercial, non-military customers. Through its specifications, the Navy imposed requirements that made the pumps it procured different in fundamental ways from pumps supplied for commercial applications.

11. Most significantly, pumps supplied to the Navy were required to and were designed to be resistant to combat conditions and damage. Navy specifications imposed strict standards for "shockproofness" – *i.e.*, resistance to combat damage to the vessel and/or the spaces where the pumps were located. (Exhibit A at 3.1; 3.3.15; 4.3.10-17; Exhibit B at 3.1; 3.10; 4.2.8-15). Compliance with these shockproofness requirements necessitated unique design and engineering

Case 4:19-cv-00326-DMR Document 1-1 Filed 01/18/19 Page 130 of 334

to ensure the necessary strength and durability for battle conditions. The Navy's shockproofness testing subjected pumps to impacts designed to simulate the effect of torpedoes, bombs or other explosives striking a vessel.

12. The Navy also dictated other characteristics unique to Navy pump applications that differed from pumps sold to commercial customers. These included, for example: stringent endurance requirements, and the testing to document them, that differed from standard commercial standards and expectations (Exhibit A at 4.1.2; Exhibit B at 4.4.2); use of different metals -- gun metal, nickel-copper alloys, specialized bronzes, and other materials -- not frequently used by Buffalo Pumps in non-military applications (Exhibit A at 3.4.1.7; Exhibit B. at 3.2.1-2); "standard" Navy sizes for input and output piping and, therefore, for the associated flanges on the pumps, that differed from those in commercial industry (Exhibit A at 3.3.16.8; Exhibit B at Fig. 1-6.); special hardware and fittings that differed from those in standard use in commercial applications (Exhibit A at 3.3.22); and specialized welding procedures different from standard welding used on commercial pumps (Exhibit A at 3.3.2.4).

13. In addition, Navy specifications or other technical documents identified in applicable contract documents required Buffalo Pumps to submit for approval and acceptance by the federal government drafts of any manuals, drawings or other written materials required to be provided with regard to pumps it manufactured for the Navy. These requirements were far more detailed and stringent than those imposed by commercial customers. (Exhibit A at 3.5; 3.6; Exhibit B at 3.27; 3.28).

14. This approval and acceptance process was not merely a process of submission by Buffalo Pumps of drawings and manuals. The Navy's review encompassed all aspects of the technical manuals and other written materials submitted to it for approval in the pump design and

manufacture process. Based on my experience and my review of historical materials, I am aware that the Navy required specific changes to the content and wording of manuals submitted by Buffalo Pumps and other naval equipment manufacturers. These changes included specific edits to cautionary and instructional language, and including warnings and cautions. Examples of correspondence of this type are attached as Exhibit C.

15. Once those manuals, drawings or other written materials were approved and accepted by the Navy, they were assigned Navy identification numbers, essentially becoming Navy documents.

Martin K. Kraft

Sworn to and subscribed
before me this 4th day
of March, 2008.

Tamara J. Walters
NOTARY PUBLIC

TAMARA J. WALTERS
Notary Public, State of New York
Qualified in Niagara County
My Commission Expires 5/9/2009
Tamara J Walters

6-15-66-1552

DE1052 Class/S47(2-2617-N)   June 15, 1966

RECEIVED
JUN 17 1966
BUFFALO PUMPS,

From: Todd Shipyards Corp.
(Seattle Division)
By Gibbs & Cox, Inc.
21 West Street,
New York, N. Y. 10006

To: Supervisor of Shipbuilding, USN, New York
Federal Office Building
29th Street and 3rd Avenue
Brooklyn, New York 11232

Subject: DE1052 - Distiller Feed Pump - Preliminary Equipment Manual.

References:
(a) Letter from Todd Shipyards Corp. (Gibbs & Cox, Inc.) DE1052 Class/S47(2-2618-N) to Buffalo Pumps Inc. dated June 15, 1966. FILE 574

(b) Detail Specification for Building Ocean Escort DE1052 Class

Enclosure: Two copies of (A)

(A) Preliminary Equipment Manual for Distiller Feed Pump - Buffalo Pumps Inc.

1. In compliance with the requirement of the specifications it is requested that a NAVSHIP number be assigned to the equipment manual, Enclosure (A). By Reference (a) the Design Agent forwarded comments on the manual to the pump manufacturer.

2. Final approved manuals will be distributed in accordance with Paragraph 9020-5-C of Reference (b).

3. It is anticipated that the final manuals will be available for distribution approximately 60 days after final approval.

4. The Supervisor's response to the above is requested by July 8, 1966.

TODD SHIPYARDS CORPORATION
(SEATTLE DIVISION)
BY GIBBS & COX, INC.
W. C. BACHMAN

R P Fulton
R. P. FULTON
By direction

RH/jo
cc: Buffalo Pumps
Buffalo, N.Y.
Todd, Seattle
Todd, New York

Mailed Copy to A. Bloom 6/17 PW

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Case 4:19-cv-00326-DMR Document 1-1 Filed 01/18/19 Page 133 of 334

6-15-66-1549

DE1052 Class/S47(2-2618-N)

June 15, 1966

From: Todd Shipyards Corp.
(Seattle Division)
By Gibbs & Cox, Inc.
21 West Street
New York, N.Y. 10006

To: Buffalo Pumps, Inc.
North Tonawanda, New York

Subject: DE1052 - Distiller Feed Pump Purchase Specification No. DE1052-517-M4710 Todd Purchase Order DES 2033 Preliminary Equipment Manual

References:

(a) Letter from Buffalo Pumps, Inc. to Gibbs & Cox, Inc. (3-18-66-64) dated March 15, 1966

(b) Buffalo Pumps, Inc. Technical Manual for Distiller Feed Pump DE1052 Class Ships

1. The Design Agent has reviewed Reference (b) as per Reference (a) and considers it satisfactory subject to the following comments:

(a) Cover

(1) Change "Technical Manual" to "Equipment Manual".

(b) Title Page

(1) As noted in paragraph 1a1.

(c) Approval and Procurement Record Page

(1) Add "Page" after "Record".

(2) Delete "Basic" and add "For" after "Data".

(3) Comment 1a1 herein applies.

(4) Delete "Approved By" and insert "Approval Authority".

(5) Insert "Purchase" between "Or" and "Order".

Mailed copy to A. Bloom 6/17

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Case 4:19-cv-00326-DMR Document 1-1 Filed 01/18/19 Page 134 of 334

1. (c) (Cont'd)

(6) Delete "Date" column.

(7) Replace "Vessels" with "Ships".

(8) Add "Quantity of Equipment" column between "Quantity of Manuals" and "Building Yard".

(9) Change "Quantity of Manuals" from "86" to "74".

(10) Delete all references to equipment used on ships built at Todd Shipyards Inc., San Pedro, California: i.e.; DE-1055, DE-1058, DE-1060, DE-1067, DE-1071, DE-1074 and DE-1076. Gibbs & Cox is the Approval Authority only for ships built at Todd Shipyards Inc., Seattle. Approval for equipment used on ships other than those built at Todd, Seattle, must be granted by the cognizant Naval authority.

(d) List of Effective Pages

(1) Delete "Effective Pages" upper left corner.

(2) Delete "Front Matter" upper right corner.

(e) Table of Contents

(1) Delete "Contents" upper left hand corner.

(2) Comment 1d2 herein applies.

(f) List of Illustrations

(1) Delete "List of Illustrations" in the upper left corner.

(2) Comment 1d2 herein applies.

1. (g) Page vii

(1) Delete "Frontispiece".

(h) Page 1-1-2

(1) Add "Prelubed" after "Ball"

(2) Change "length" from 2'-7-7/8" to 31-7/8"

(i) Page 1-3-1

(1) Delete item 3. "Lubrication of Motor" since the bearings are prelubricated and sealed and require no lubrication.

2. In addition to the above comments the manufacturer will be required to include an electrical section covering the motor. This section will be furnished by the motor manufacturer. The Table of Contents should include the motor section.

3. By separate correspondence, to the Supervisor, the Design Agent is requesting that a NAVSHIPS No. be assigned to this manual.

4. It is requested that the pump manufacturer resubmit the subject Equipment Manual, including the electrical section, for review by the Design Agent by July 5, 1966.

TODD SHIPYARDS CORPORATION
(SEATTLE DIVISION)
BY GIBBS & COX, INC.
W. C. BACHMAN

R P Fulton

R. P. FULTON
By direction

EI/al

cc: SupShip, N.Y.
Todd, Seattle
Todd, N.Y.

7-28-66-1587

DE1052 Class/S47(2-3376-N)

July 28, 1966

From: Todd Shipyards Corp.
(Seattle Division)
By Gibbs & Cox, Inc.
21 West Street,
New York, N.Y. 10006

RECEIVED
AUG 1 1966

To: Buffalo Pumps,
North Tonawanda, N.Y. 14121

Subject: DE1052 Class - Distiller Feed Pump -
Purchase Specification DE1052-517-M4710
P.O. DES-2033 - Equipment Manual, Review of

References:
(a) Letter from Buffalo Pumps Inc. to Gibbs & Cox, Inc. dated June 30, 1966 (7-1-66-66).

(b) Buffalo Pumps Inc. Equipment Manual for Distiller Feed Pump for DE1052 Class Vessels.

1. Reference (b) forwarded by Reference (a) has been reviewed by the Design Agent and is considered satisfactory subject to the following comments:

(a) On the cover and title page delete "Bureau of Ships" and in its place insert: "Naval Ship Engineering Center, Washington, D.C."

(b) Page 1-1-1 under "Pump"
(1) After "Actual Shut off Head" insert actual data.

(2) Delete "structure borne noise Group C".

(c) Page 1-1-2 under "Overall dimensions of assembled unit" height should be "22-1/8".

(d) Page 1-1-4 - Paragraph 1-1-3 add "and Resilient Mounts" following "Mounting Subbase". In second sentence after "....foundation" add "to reduce sound transmission".

(e) Page 1-2-1 - In the first sentence under Piping delete "all" and substitute "Normally all rigid...." Before the fourth sentence add, "However since this pump is resiliently mounted, flexible hoses are to be installed to reduce sound transmission and will also prevent piping stresses on the pump."

Copy sent to A. Blann BW 8/1/66

Case 4:19-cv-00326-DMR Document 1-1 Filed 01/18/19 Page 137 of 334

DE1052 Class/S47(2-3376-N)

1. (Cont'd)

(f) Page 1-3-1, Paragraph 1-3-1
(1) Under "Warning" add the following "Never use water on electrical fires. Use CO_2." Also add "When servicing pump, disconnect from sources of electrical power and tag."

(2) After "Pump priming", add "Insure that pump is completely filled with liquid."

(g) Page 1-3-1 Paragraph 1-3-2 the step 2 after "primed" add "and vented. Then close vent valve."

(h) Page 1-3-2 Paragraph 1-3-5 under "Vibration", in the second paragraph delete "to acceptable limits" and specify these limits. Also identify the locations for taking readings.

(i) Page 1-4-1, Paragraph 1-4-2 in the first sentence under "Trouble Shooting" delete "Listed below are" and substitute "Table- - - lists" at end of sentence add "and remedies".

(j) Page 1-4-2 - Delete paragraph number 1 to 5 and substitute table in the form "Trouble, Probable Cause, Remedy" including:

(1) For "No Discharge", Probable Cause should include Pump not primed, Speed too low, Impeller completely plugged, Plugged suction line or strainer, Pump not running and Impeller locked. Also indicate corresponding remedies.

(2) For "Insufficient Discharge", Probable Cause should include Air leaks in suction or stuffing box, Speed too low, Clogged suction line screen or impeller, Mechanical defects: Wearing rings worn; Impeller damaged. Also indicate corresponding remedies.

(3) For Insufficient Discharge Pressure, Probable Cause should include Speed too Low, Air or gases in liquid, Wrong direction of rotation, Mechanical Defects: Wearing rings worn; Impeller damaged. Also indicate corresponding remedies. For Air or gases in liquid, remedy is "Check suction for leaks. Vent frequently."

DE1052 Class/S47(2-3376-N)

1. (j) (Cont'd)

(4) For "Loss of Suction," Probable Cause should include Air or gases in liquid, Defective Casing Gasket. Also indicate corresponding remedies.

(5) For "Excessive Power Consumption", Probable Cause should include Speed too high, Mechanical Defects: Shaft bent, Rotating element binds. Also indicate corresponding remedies.

(6) Add Trouble "Stuffing box overheats or excessive stuffing box leakage". Probable Cause should include Insufficient cooling water to stuffing box, Excessively worn packing, Lantern ring installed between wrong packing rings, Excessive pressure in stuffing box, Seal cage plugged. Also indicate corresponding remedies.

(7) Add Trouble "Noisy Installation or Excessive Vibration". Probable Cause should include Loose mounting bolts, Mechanical defects, Impeller or motor imbalanced, Air or gases in liquid, Foreign matter in pump, Misalignment. Also indicate corresponding remedies.

(k) Page 1-4-4 Following paragraph 2 under "Wearing Rings", add the following: "Resilient Mounts - make regular checks on resilient mounts. A normal service life of 5 years is expected unless damage or prior loss of effectiveness require earlier replacement. Resilient mounts should be replaced at such time when their performance is deemed ineffective or as specified by current BuShips instructions".

2. By separate correspondence to the Navy, the Design Agent has requested the assignment of a NAVSHIPS number.

3. The manual shall include an Electrical Section. This approved section will be forwarded by the motor manufacturer for insertion by the pump manufacturer.

DE1052 Class/S47(2-3376-N)

4. It is requested that the pump manufacturer's acceptance of the above comments be forwarded to the Design Agent by August 15, 1966. Resubmittal is not required.

TODD SHIPYARD CORPORATION
(SEATTLE DIVISION)
BY GIBBS & COX, INC.
W. C. BACHMAN

R P Fulton

R. P. Fulton
By direction

RH/jo

cc: SupShip, N.Y.
Todd, Seattle
Todd, New York

Copy to Art Bloom
3/15/68 RMS

File 570

3-6-68-1596

DE1052 Class/S58(2-6207-N)

March 5, 1968

From: Todd Shipyards Corporation
(Seattle Division)
By Gibbs & Cox, Inc.
21 West Street
New York, New York 10006

To: Aqua-Chem, Inc.
225 North Grand Ave.
Waukesha, Wisconsin 53186
Attn: Mr. R. E. Buttner

Subject: DE1052 Class - Distilling Plant - Distiller Distillate Pump & Distiller Sea Water Heater Drain Pump - Purchase Specification No. DE1052-517-M5800 - P.O. DES-2016 Preliminary Technical Manual - Approval of

References:

(a) Letter from Aqua-Chem, Inc. to Gibbs & Cox, Inc., dated 9 November 1966 (11-14-66-120)

(b) Preliminary Technical Manual for Distiller Distillate Pump & Distiller Sea Water Heater Drain Pump

(c) Preliminary Technical Manual for Aqua-Chem, Inc. 12,000 GPD Flash Type Distilling Plant (Model S500FL2H)

(d) Military Specification MIL-M-15071E(Ships)

1. Reference (b), forwarded via Reference (a), has been examined in conjunction with Reference (d) and the subject purchase order specifications. In this regard, Reference (b) is considered satisfactory for publication and distribution, subject to the manufacturer's compliance with the following comments:

(a) Cover Layout

(1) Delete "Bureau of Ships" and insert "Naval Ship Systems Command".

(2) Insert the appropriate NAVSHIPS Number, when available.

(b) Title Page

(1) Comments 1.a.1 and 1.a.2 apply herein.

1. (Cont'd)

(c) Approval and Procurement Record Page

(1) The appropriate NAVSHIPS Number should be added under the Approval Data and the Certification Data columns.

(2) The approval authority should be delineated as follows:

"Approved by Todd Shipyards Corp. (Seattle Division) (G&G) letter DE1052 Class/S58(2-6207-N), dated March 5, 1968

(d) Table of Contents & List of Illustrations

(1) It is noted that the manual does not contain the appropriate motor and controller inserts for each pump. Accordingly, the approved inserts should be added, when available. Additionally, the Table of Contents should be revised to indicate a separate chapter for each pump, motor and controller.

(2) Pursuant to comment 1.d.1, it is recommended that each chapter of the manual be divided by an appropriate separator.

(3) On Page 1-i, insert Section 7, entitled Motor and Controller, and add the appropriate page number.

(4) In line with comment 1.d.1, the motor and controller drawings should be included as illustrations. The appropriate page numbers should be indicated on Page 1-ii.

(e) Section 1 - General Data (Distiller Distillate Pump)

(1) On Page 1-1-1 add the phrase "At Rating" in conjunction with the 1.09 BHP.

(2) The Military Specification for the motor should be changed to MIL-M-17060B. Additionally, the Design Agent notes that this information is also in error on Figure No. 1-6-1.

1. (e) (Cont'd)

(3) It is noted that the weights for the subject equipment, shown on Page 1-1-2, are calculated weights. This information should be reflected therein.

(4) On Page 1-1-2, under Reference Drawings, the manual should list the appropriate number for reference..

(f) Section 1 - Detailed Description

(1) Under the paragraph on the casing, Page 1-1-3, make the following changes:

(a) Delete the word "Spigot" in the second sentence, and insert the word "Stepped".

(b) In the fourth sentence, identify the drain plug as Pc. No. (34), the vent cock as Pc. No. (26), and the flanged seal water connection as Pc. No. (41).

(2) Revise the last sentence of the paragraph on the motor bracket to read as follows:

"The motor bracket contains drain fittings which may be used to remove leakage from the stuffing box".

(g) Section 3 - Operating Instructions

(1) Inasmuch as the motor, utilized for this installation, is equipped with sealed bearings, any reference to motor lubrication is inappropriate. Therefore, Item 3 under Section 1-3-1 should be deleted.

(h) Section 4 - Maintenance

(1) The second sentence of Item 2 under Annual Maintenance Procedure, Page 1-4-1, should be revised as follows:

"When clearance has increased to double the initial value, the original clearance, as shown on Page 1-1-2, should be restored by replacing the affected parts".

1. (h) (Cont'd)

(2) The Trouble Shooting Table, on Pages 1-4-2 to 1-4-5, should be modified to accommodate the following:

(a) Under "Noisy Installation", delete the Cause and Remedy for "Specific Gravity of the Liquid Too High". Revise the remedy for "Speed Too High" to read as follows: "Check the Driver for High Speed, Refer to the Applicable Trouble Shooting Tables".

(b) Comment 1.h.2.a applies to the section on "Pump Overloads Driver".

(c) In addition to the present remedy for "Suction Lift Too High" under the topic "Pump Loses Prime After Starting", add the following remedy: "Check the Level in the Supply Tank".

(d) Comment 1.h.2.c applies to the cause of "Suction Lift Too High", under the topic of "Pump Discharge Pressure Low".

(e) Under the topic of "Low Capacity" revise the remedy, for "Speed Too Low", to read as follows: "Check Speed of Driver and Refer to the Applicable Trouble Shooting Tables".

(i) Section 1-4-5 - Reassembly (Page 1-4-2)

(1) The second sentence in Item 7 should be revised to read as follows: "Coat both sides of the gasket with a graphite-oil mixture."

(2) In Item 9, delete the word "Correct" and insert the word "Connect".

(3) Delete Item 11, and insert the following: "Start the Unit and Check for Leaks".

(j) Table of Contents (Distiller Sea Water Heater Drain Pump)

(1) Comments 1.d.1 to 1.d.4 inclusive apply to Pages 2-i and 2-ii.

1. (Cont'd)

(k) General Information Page 2-1-1- & 2-1-2

(1) Under General Data, delete the words "Close Coupled" and insert "Flexibly-Coupled".

(2) Delete "Buffalo Shop Orders - 550373-400" and insert "Class - D-1: Horizontal, Multi-Stage".

(3) Between the items of "Total Head, PSI" and "Specific Gravity", insert "Liquid Handled - Water".

(4) Delete "Rotation - CCW", or further qualify this item to indicate the location from which the rotation is viewed, i.e. CCW as viewed from the pump end, or CCW as viewed from the motor end.

(5) Comment 1.e.3 applies to the weight information on Page 2-1-2.

(6) Under General Data for the Motor, Page 2-1-2, add the following: "Military Specification MIL-M-17060B".

(7) Comment 1.e.4 applies to the reference drawing information on Page 2-1-2.

(l) Detailed Description - Pages 2-1-4 & 2-1-5

(1) In the second paragraph under the topic of "Casing", correct the spelling of the word "Labyrinth".

(2) Under the topic of "Bearings", after the last sentence, add the following: "Note: See Table 2.4.1".

(3) On Page 2-1-5, under the topic of Lubrication, add the following: "Note: See Table 2.4.1".

(m) Installation - Section 2

(1) On Page 2-2-3 revise Item 11 to read as follows:

"It it becomes necessary to realign the pump and motor, so that the original dowels between the pump or motor and the subbase are no longer in alignment, drill and ream new dowel holes and install new dowels. Be sure that all hold down bolts are drawn up tightly while drilling and reaming dowel holes".

1. (Cont'd)

(n) Trouble Shooting

(1) The Trouble Shooting Table, on Pages 2-4-2 to 2-4-5, should be modified to accommodate the following:

(a) Comment 1.h.2.a applies to the section on "Noisy Installation", and to the section on "Pump Overloads Driver".

(b) Comment 1.h.2.c applies to the cause of "Suction Lift Too High" under the trouble of "Pump Loses Prime after Starting" and the trouble of "Pump Discharge Pressure Low".

(c) Comment 1.h.2.e applies to the trouble of "Low Capacity".

(d) Under the trouble of "Stuffing Box Overheats", add the following cause and remedy: "Improper Installation of Seal Cage and Packing --- check to see that the Seal Cage and Packing are inserted in the proper sequence (See Fig. 2-6-2)".

(o) Adjustments and Tests - Page 2-4-6

(1) Revise the "Pressure Test" procedure to read as follows:

"After complete reassembly, start the unit. Carefully inspect the unit for leaks, and correct as required".

(p) Maintenance and Repair - Section 2-4-5

(1) On Page 2-4-9, under the topic of gaskets, delete the last sentence and insert the following:

"Coat both side of the gaskets with graphite and oil before replacing the gaskets".

(q) Rotor Installation - Page 2-4-10

(1) Under Item 5, on Page 2-4-11, delete the second sentence and insert the following:

"Reconnect the piping, if disconnected, and start the unit".

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DE1052 Class/S58(2-6207-N) -7-

2. The subject manual should be revised in accordance with the foregoing. Upon receipt of a NAVSHIPS Number and compliance with the above, the manufacturer should effect publication and distribution in accordance with purchase order requirements.

3. By separate correspondence, the Design Agent is requesting a NAVSHIPS Number for the subject manual. The NAVSHIPS Number will be forwarded to the manufacturer as soon as it becomes available.

4. It should be noted that action on Reference (c) is the topic of separate correspondence. Notification of approval of Reference (c) and the appropriate changes required thereof, will be forwarded to the manufacturer as soon as it becomes available.

5. Acknowledgement of compliance with the above is requested by 29 March 1968.

TODD SHIPYARDS CORPORATION
(SEATTLE DIVISION)
BY GIBBS & COX, INC.
W. C. BACHMAN

R P Fulton

R. P. FULTON
By direction

RLB/crc

cc: Todd, Seattle

Todd, New York

Buffalo Pumps
North Tonawanda, N.Y. 14121
Attn: Mr. R. Hardison

Strategic and Critical Materials Reference

EXHIBIT 4

TO DECLARATION
OF REAR ADMIRAL BEN J. LEHMAN (RET.)

U. S. ARMY AND NAVY MUNITIONS BOARD.

THE STRATEGIC AND CRITICAL MATERIALS

[illegible]

[illegible]

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J.C.S. - II M.

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INTRODUCTION

This pamphlet is intended as a primer on the subject of the strategic and critical materials and to serve as a reference and guide to those who are interested in this particular phase of industrial preparedness. It can hardly serve more than to give a general picture of the scheme of things and perhaps remove some of the common misunderstandings that obtain in relation to the sources, production, quality, and uses of these materials, both from a military and industrial point of view. For details the initiated and technical reader should refer to special texts, references and the established and authoritative agencies dealing with the various items or groups of materials herein involved. A few of the many available references are included in a list of references attached hereto.

Previous issues of this pamphlet were under dates and titles as follows:

Sept. 1, 1938 - "Strategic and Critical Materials Their Relation to National Security".

Nov. 15, 1938 - "Strategic and Critical Materials Their Relation to National Security".

Mar. 29, 1939 - "Commodities Considered Problematical"

Nov. 6, 1939 - "Commodities Considered Problematical"

THE ROLE OF STRATEGIC AND CRITICAL
MATERIALS IN INDUSTRIAL PREPAREDNESS PLANNING

Since the inception of industrial preparedness, planning for the materials essential to national defense, the procurement of which in an emergency might offer difficulties, has been given continued study. Planning with respect to these materials continues today on a sounder basis and with more active public interest and support than has obtained in the past.

Perhaps nations, as men, were not made to live alone, economically or otherwise. However, should a nation at war be isolated it must meet the conditions resultantly imposed. As for those basic materials by which life is sustained and those from which implements of war are fabricated, the isolated nation must supply its own or suffer in proportion to its inability to meet its needs.

Modern life makes great demands upon industry. Such demands have built our vast and complicated industry of today. Modern war will make even greater demands on this industry. The supply of raw materials which feeds it must continue undiminished, and in some cases at a greatly increased rate. Those vital materials we produce in abundance domestically are no problem. What of those we do not produce? What of those we produce but not in quantity adequate for our defense needs in a major war?

It is with these materials we are here concerned. Richly endowed with resources as we are, there are a number of materials for the supply of which we must look to nearby foreign lands or overseas. Some of these we may obtain from our own Western Hemisphere. However, there are other materials essential to national defense which must be supplied from other areas and which may be denied to us.

There are four practical approaches to the solution or partial solution of the problem of an emergency supply of strategic and critical materials to meet our needs during such a period. Probably all four will be necessary to the degree in which it may be possible to apply them. They are by:

1. Development of domestic production of these materials on a scale equal or partially equal to requirements.

2. Development of substitutes.

3. Maintaining friendly relations with the nations who control the sources and distribution of these materials and by keeping trade routes open to the principal sources.

4. Acquiring adequate stock piles of these materials in time of peace as a war reserve, particularly those which offer the most difficulty of solution by the foregoing methods.

Control measures are necessarily applicable to varying degrees under each measure. Only the last can offer absolute assurance unless and until the others are fully and completely developed and executed.

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CURRENT LIST OF THE STRATEGIC AND CRITICAL MATERIALS

On January 30, 1940, the Army and Navy Munitions Board approved the following definitions and lists of strategic and critical materials:

DEFINITIONS

STRATEGIC MATERIALS. Strategic materials are those essential to national defense, for the supply of which in war dependence must be placed in whole, or in substantial part, on sources outside the continental limits of the United States; and for which strict conservation and distribution control measures will be necessary.

CRITICAL MATERIALS. Critical materials are those essential to national defense, the procurement problems of which in war would be less difficult than those of strategic materials either because they have a lesser degree of essentiality or are obtainable in more adequate quantities from domestic sources; and for which some degree of conservation and distribution control will be necessary.

STRATEGIC MATERIALS (14)

Antimony	Mercury	Rubber
Chromium	Mica	Silk
Coconut Shell Char	Nickel	Tin
Manganese, ferrograde	Quartz Crystal	Tungsten
Manila Fiber	Quinine	

CRITICAL MATERIALS (15)

Aluminum	Iodine	Platinum
Asbestos	Kapok	Tanning Materials
Cork	Opium	Toluol
Graphite	Optical Glass	Vanadium
Hides	Phenol	Wool

The Army and Navy Munitions Board maintains a list of, and keeps under surveillance, certain additional materials which might become strategic or critical.

ANALYSIS AND EXPLANATION OF THE LIST

Let us analyze the definitions. Briefly paraphrased they are:

Strategic materials are those necessary to our nation for national defense purposes because they are not domestically produced in sufficient quantity or quality.

Critical materials are those equally essential as strategic materials and which may offer difficulties but for a number of reasons probably will not present as great a problem.

As to the other materials not included in these two categories and referred to as being on a surveillance list, any or all of them may for one reason or another become strategic or critical at some time. By the same token, some or all those listed in the first two categories may be dropped as we make ourselves more self-sufficient nationally, develop substitutes, or replace them by other materials. At one time shellac, camphor, nitrates and other materials were on the above lists. Time and scientific developments have relieved us of their requirement worries. Perhaps silk, coconut shell char and others now on the list may follow them into the discard for planning purposes.

All of the materials on the current list are not of equal priority with others under the same classification. One material may offer greater problems of procurement than another material. One material might possibly be dispensed with at a cost which might be bearable under certain conditions; another may be indispensable at any cost.

A discussion of each of the materials follows:

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STRATEGIC MATERIALS

ANTIMONY

One of the principal uses of antimony is in the manufacture of plates for storage batteries. Other uses are for type metal, cable covering, babbitt and other bearing metals, chemicals and pigments. Pure antimony metal has little use beyond a small amount of ornametal castings. The largest part of the entire output is used in alloys with other non-ferrous metals, chiefly lead. Military uses are as above plus uses in primer mixtures, pyrotechnics and bullet alloys.

Antimony is marketed in several different forms: antimony oxide, liquated antimony sulfide (needle antimony), "Matte", (an impure metallic product), and "Regulus" (an intermeidate product obtained during the smelting of ores). Antimony is available not only in the foregoing forms, but also as a secondary or recovered antimony, large quantities of which are regularly returned to use. The consumption is mainly dependent upon the rate of general industrial activity. The metal is relatively cheap and there is little incentive to use it sparingly. The average price over the past 10 years has been approximately 10 cents per pound.

Formerly the United States obtained a very large portion of its antimony from China, but in recent years South and Central America have been chief sources of U.S. imports. The only primary antimony smelter in the United States is located in Laredo, Texas, and operates almost wholly on Mexican ores.

U. S. IMPORTS FOR CONSUMPTION (short tons) FOR 1938

Country	Ore Antimony Content	Metal	Total Antimony
Argentine	715		715
Bolivia	1133		1133
Chile	776		776
China	43	661	704
Mexico	5250	112	5362
All others	405	48	453
Total	8322	821	9143

WORLD PRODUCTION 1938 (metric tons)

Africa	1,043
Bolivia	8,682
China	7,797
Europe	1,231
Mexico	7,391
United States	543
All others	2,813 (estimated)
Total	29,500 or 32,524 short tons

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CHROMIUM

Chromium is one of the more important industrial elements for which this country is dependent almost entirely on foreign sources of supply. Of all the minerals containing chromium, chromite is the only one of commercial importance as an ore of chromium. The industrial uses of chromium fall into three groups - metallurgical, refractory, and chemical, in the order of importance as listed. Of the numerous ferroalloys in which it is used to make steels designed for specific purposes, probably stainless steel containing typically 18% chromium is the best known. Other chromium-bearing steels containing smaller or larger amounts have been developed to meet special needs of industry. Alloy steels find definite applications, both civilian and military, and as the steel industry shifts to alloy steels from straight carbon steels, chromium assumes increased significance. Chromium chemicals are used in the tanning of leather, the manufacture of pigments, and in electroplating. Chromite refractories are essential to many metallurgical processes. For many uses of chromite there are no satisfactory substitutes.

Three-fourths of the world's supply of chromite comes from five countries in the following order: U.S.S.R. 20%; Southern Rhodesia 17%; Union of South Africa 16%; Turkey 15% and Cuba 7%. The latter is the only important source in the Western Hemisphere and its output is far below that necessary for our consumption. Furthermore, the grade is such that the ore is suited only for refractory use and cannot be used for the manufacture of ferrochrome, the intermediary ferroalloy used in the steel industry. As domestic production is insignificant, we are dependent on overseas shipments for our supply. In 1938 we imported 352,085 long tons of chromite with a chromic oxide content of 163,370 long tons. During the same year we produced domestically only 812 long tons of chromite. Our imports were chiefly from Southern Africa, Philippine Islands, New Caledonia, Cuba and Turkey. Domestic resources of metallurgical grade ore are virtually non-existent and reserves of lower grade material are extremely limited and submarginal under normal conditions.

The usability of chromite is normally determined by the ratio between iron and chromium in the ore. Iron increases the fusibility of chromite, making it less desirable for refractories, whereas a high iron content renders chromite less usable for making ferrochromium. The usual ratio of chromium to iron in commercial chromite is about $2\frac{1}{2} : 1$. The ratios of chromium to alumina, to magnesia, and to silica are important also because these constituents increase the amount of slag made in ferrochromium smelting and thus increase the metallurgical loss of chromium. Silica is generally limited to 5%, as it is undesirable in ferrochromium, except for making a few special alloys. Much of the better foreign ores contain from 48 up to 55% of chromium sesquioxide, but the average domestic ore has a content of only about forty percent and its iron content is relatively high. Concentration by gravity of domestic ores of high iron content usually increases the iron content as well as that of chromium, so that the ratio is little improved.

COCONUT SHELL CHAR

Charcoal made from coconut shells, by firing the shells in a confined space with little or no oxygen, has long been considered the best absorbent filling for gas mask canisters. The basic material, coconut shells, is produced in most tropical countries and islands. However, a large portion is burned as fuel in the drying of the meat to produce copra. Coconut growth is confined to tropical sea areas because both saline water and tropical climate are necessary for productive trees.

Since the civilian population must be considered equally with the military for gas mask protection in a major emergency of the future, the production of gas masks during such a period will not be limited to military equipment. Hence, an unusually large number may be necessary, thus increasing component raw material requirements proportionately.

Great progress has been made in the development of satisfactory substitutes for coconut shell char from domestic materials which are abundantly available. It is believed that within the next year large scale production of an entirely satisfactory non-coconut charcoal for gas mask canisters will be available and thus eliminate this now strategic material from this list.

MANGANESE. ferrograde

Manganese ore suitable for the iron and steel industry has attracted a great deal of attention as a strategic commodity. The type of ore required by this industry must be of metallurgical grade containing a minimum of 48% manganese to be suitable for the manufacture of 78 to 80% ferromanganese, the alloy which is essential in modern manufacture of steel. While relatively minor amounts are used in other industries and for other purposes, manganese of this quality is indispensable in the present art of steel making where it serves two purposes; first, as a deoxidizer and purifying agent in all steel manufacture; and second, as an alloying element where the addition of manganese produces properties desired for special purpose steels. Our steel industry alone uses approximately 14 pounds of manganese in the form of ferromanganese for every ton of steel produced. There are no satisfactory substitutes for manganese in steel manufacture.

Normally more than 90 per cent of the world's manganese ore comes from the U.S.S.R., British India, Gold Coast, Union of South Africa and Brazil. Russia alone generally accounts for more than half. Brazil and Cuba are the principal producers in the Western Hemisphere, but with present installed equipment the combined output of these two countries could supply only a part of our needs.

Proven domestic resources of metallurgical grade ore are extremely limited. High tariff protection to domestic producers over more than a decade failed to develop any substantial production from low grade deposits. A need of stock manganese ore as a first line of defense is apparent. It seems equally important that our known and limited domestic resources of high grade ore be used as a second line of defense for an emergency rather than to currently deplete our limited deposits of such ores.

The Bureau of Mines states that the indicated consumption of manganese ore, of 35% or more Mn content, 1936 to 1938 inclusive was respectively 848,491; 954,503; and 509,932 long tons. Steel ingot production for these three years was 68.4, 72.5 and 39.6%, respectively of capacity. Therefore, a year of approximately full capacity steel production, as would certainly be necessary during a corresponding period of a major war effort, would require about a million long tons of metallurgical grade ore for the steel industry alone.

U.S. MANGANESE ORE IMPORTS FOR CONSUMPTION, LONG TONS (35% or more Mn)

Country	1938	1939
U.S.S.R.	166,043	135,243
Gold Coast	126,858	242,923
Brazil	29,698	42,713
British India	25,480	105,935
Cuba	131,423	89,544
Others	4,086	10,771
Total	483,588	627,129

These imported ores averaged approximately 48% manganese content. In addition considerable ferromanganese was imported. The manganese content of imported ferromanganese was 21,118 long tons in 1938 and 33,452 in 1939.

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MANILA FIBER

Manila Fiber (Abaca) is a long, strong, hard fiber, cream white to brown in color, that is obtained from the leaf stems forming the trunk of the abaca plant (musa-textilis). The entire world supply of high grade abaca is produced in a limited number of provinces in the Philippine Islands. Furthermore, about 75% of the total supply of abaca fiber used in this country is produced in one province - the province of Davao in Southern Mindanao.

There is no known satisfactory substitute for abaca fiber in making the high grade rope that is absolutely essential for marine cordage, oil well cables, and construction work. Manila rope made from manila fiber has the following characteristics not found in any other rope;

1. Manila rope has the greatest tensile strength, size for size, of any fiber rope.

2. Manila rope is far superior as regards the resiliency or elasticity, the characteristic that is absolutely necessary for marine use, to any other type of rope, wire or chain.

3. Manila rope has a long life under the most rigorous weather conditions, - cold, frost, heat, sun, alternate wetting and drying do not materially affect the condition of the rope.

4. Manila ropes used aboard ship are mainly reeved through blocks. Manila rope retains size when wet, does not appreciably swell or shrink, as is true of other fiber ropes.

There is no manila fiber produced in the United States, but experimental growing of abaca in Central America has been under way for several years. It has been satisfactorily demonstrated that large areas of former banana lands are suitable for commerical cultivation of abaca.

The necessity for cheap labor in stripping the pulp from the fiber has held up commercial production in Central America, but is is hoped that perfection of mechanical methods of stripping will turn out high grade production at a cost which will permit these regions - where labor rates are relatively high - to compete with Philippine abaca produced by cheap hand labor.

Over 45,000 tons of manila fiber valued at $4,171,888 were imported into the United States during 1939.

MERCURY

The problem of supply presented by mercury (quicksilver) from a national defense point of view is apparent. The civilian and military uses are indispensable to a large degree and it is doubtful whether the United States, even with extremely high prices, can supply its needs of this metal over an extended emergency period. Its military uses are principally in the manufacture of fulminate for detonating high explosives, drugs, dental amalgam, anti-fouling paint for ship bottoms and for many industrial activities ranging from the production of gold to the disinfection of seeds. In addition to the foregoing, its civilian uses include the generation of power from mercury boilers, mercury vapor lamps and the manufacture of felt. The average annual consumption of mercury in the United States for the last ten years has been about 28,000 flasks (76 lbs. each). During the period 1917 and 1918, our average consumption was 35% above that for the preceding three years. The inference may be made that the possible increase in consumption to be expected in war would be approximately 35% greater than that of the preceding normally high year. While many substitutes have been developed, particularly lead azide as a substitute for mercury fulminate, mercury remains undisplaced for many important industrial and military uses.

Under normal conditions, two-thirds of the world's output of mercury comes from Spain, and the United States ranks third. The only other present source of mercury in quantity in the Western Hemisphere is Mexico, producing about half as much as the U.S. The United States ranks as the largest consuming country of mercury, normally using approximately 30,000 flasks of which roughly half is imported. Self-sufficiency in mercury could be made possible only at prices greatly above those prevailing at present and the period of self-sufficiency would probably be very limited at any price.

Mercury prices have advanced materially within the past year chiefly due to the Spanish Revolution when the production of that country was limited and the European situation which has since developed. It is reported that the entire Spanish mercury production for 1940 has been obligated at a value of approximately $200 per flask. World price is presently around $180 per flask whereas for years it has been under $100.

While mercury is an important strategic material, it is not anticipated that as difficult a problem of emergency supply will be encountered as that of some of the other higher priority strategic materials such as tin, rubber, manganese and chromium, largely due to our partial self-sufficiency and stocks normally maintained by industry.

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MICA

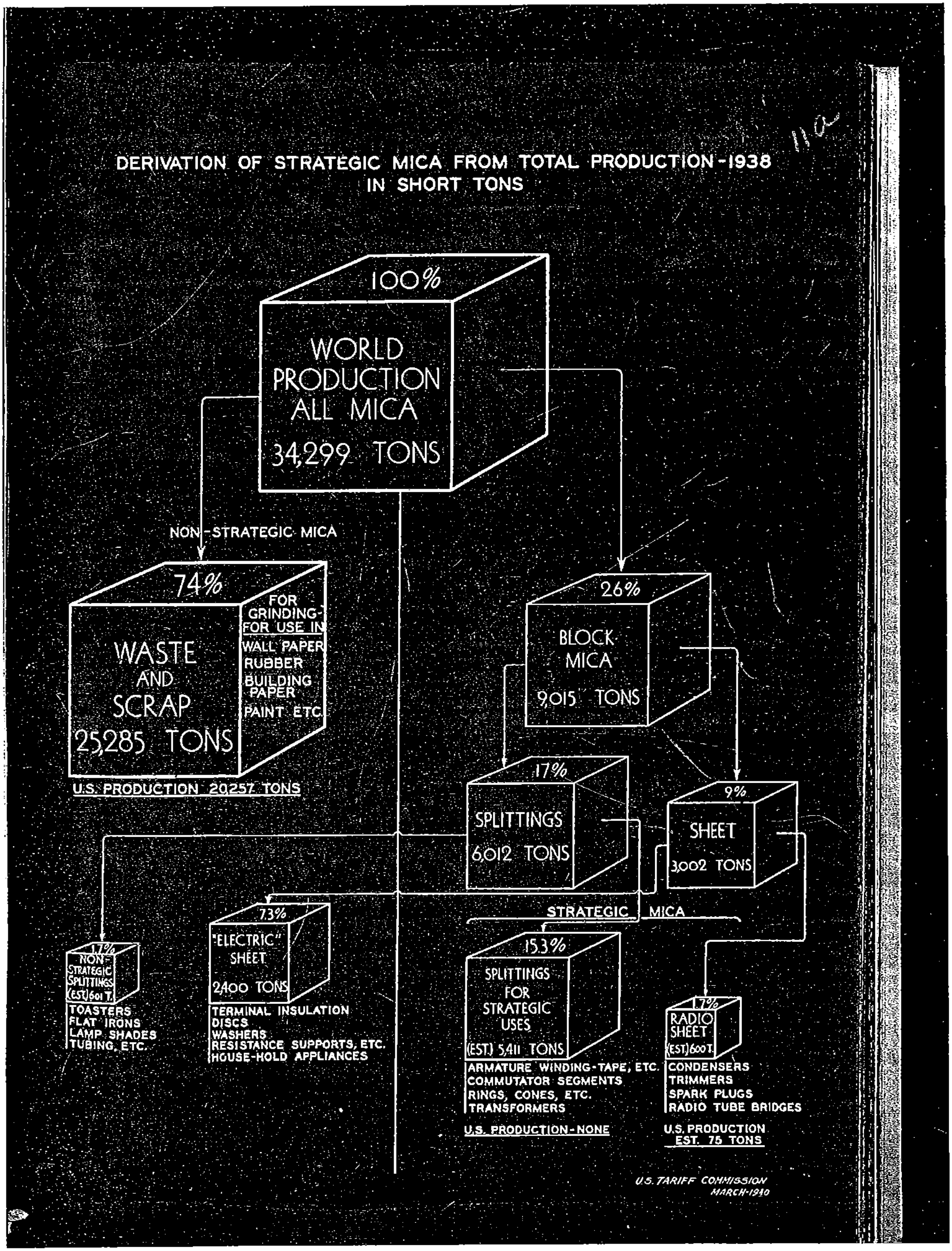
There are numerous kinds and many uses of mica. World production may be divided into two main kinds: (1) Waste and scrap mica, comprising 74% of production and (2) block mica, comprising the remaining 26%. Only with the latter are we concerned from a strategic point of view, since it is from block mica we obtain the types of mica included on the list of strategic materials. From block mica is produced splittings and sheets. Only a part of these splittings and sheets is of suitable type for classification as strategic.

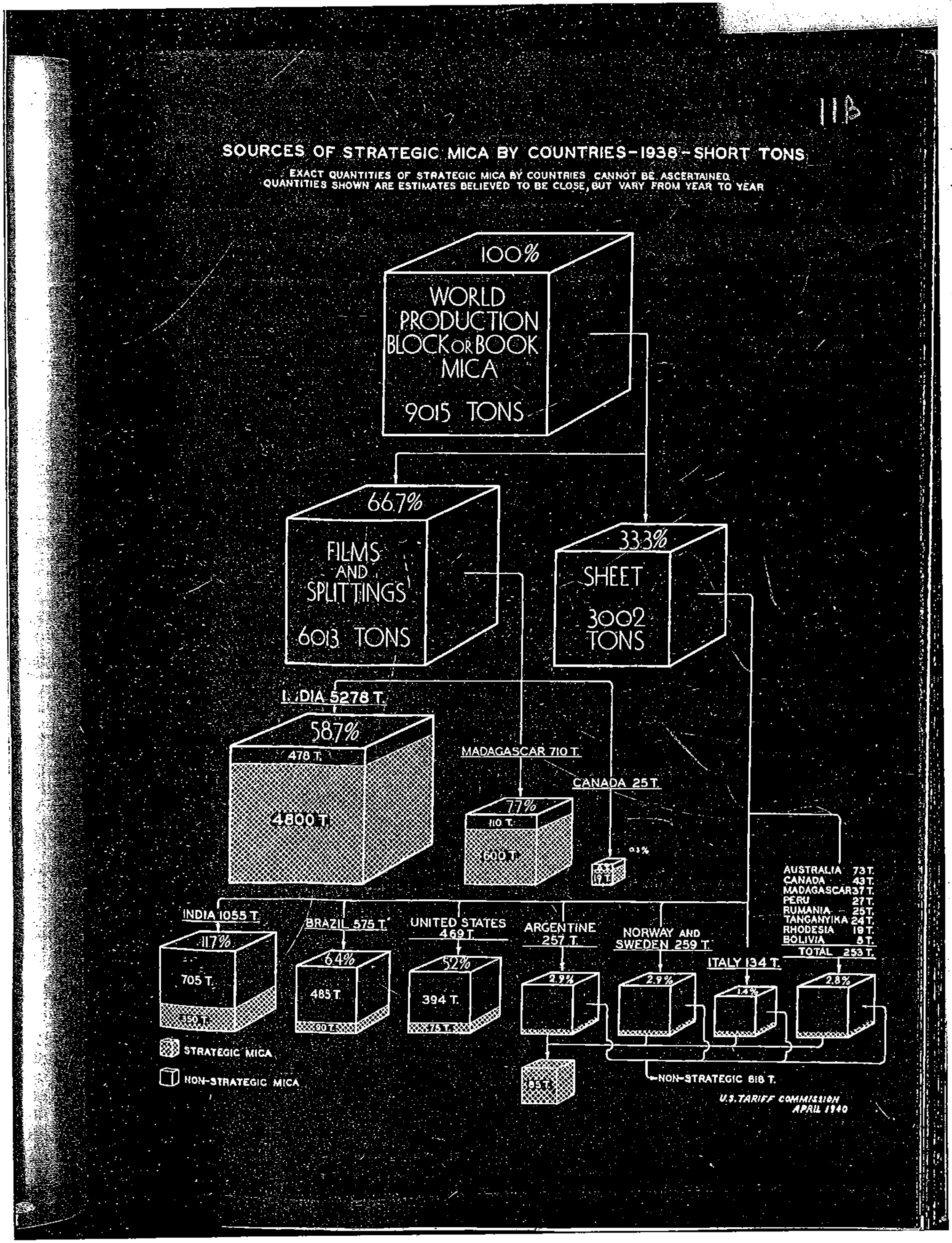
Strategic mica splittings after their manufacture into built-up plate are used for armature/winding-tape, commutator segments, rings, cones and transformers. Estimated world production is 5,411 short tons of which none is produced in the United States. Strategic sheet mica (radio sheet) is used for condensers, trimmers, high grade spark plugs, radio tube bridges and magneto condensers. Of an estimated annual world consumption of 600 short tons, the United States annually produces approximately 75 tons or 13%. Of both types (sheets and splittings) we produce less than 1% of world production. These particular types of strategic mica should not be confused with other types which offer no problem of supply in an emergency. Of the waste and scrap mica we produce about four-fifths of world production. This mica is generally ground, either wet or dry, for use in wallpaper, rubber, paint, roofing material, and many other miscellaneous purposes.

British India is by far the greatest world producer of block mica normally accounting for about 75% of all such production. Madagascar and Canada produce most of the remainder of this type.

The Minerals Yearbook, 1939 states "for many years mica has been considered one of the few materials for which no acceptable substitute was available in many of its principal uses. Recent laboratory research indicated that a product (Alsifilm) made from bentonite may compete successfully with mica in the important electrical field, if it can be produced commercially. Another challenge to sheet mica and mica splittings may come from properly processed ground mica, though this development seems to be less far advanced than Alsifilm * * * *"

The complexity of grading and classifying sheet mica is indicated by the fact that at least 100 distinct products can be classed as unmanufactured mica. Not only do the sheets vary enormously in size but there are at least six different qualities ranging from clear to black-stained. Since all the types of mica have so many and varied uses and their specifications, derivation and sources are highly complicated, source and derivation charts are included over-leaf.


110a
DERIVATION OF STRATEGIC MICA FROM TOTAL PRODUCTION - 1938
IN SHORT TONS
100%
WORLD PRODUCTION ALL MICA
34,299 TONS
NON-STRATEGIC MICA
74%
WASTE AND SCRAP
25,285 TONS
FOR GRINDING - FOR USE IN
WALL PAPER
RUBBER
BUILDING PAPER
PAINT ETC.
U.S. PRODUCTION 20,257 TONS
26%
BLOCK MICA
9,015 TONS
17%
SPLITTINGS
6,012 TONS
9%
SHEET
3,002 TONS
STRATEGIC MICA
1.7%
NON-STRATEGIC SPLITTINGS
(EST.) 601 T.
TOASTERS
FLAT IRONS
LAMP SHADES
TUBING, ETC.
7.3%
"ELECTRIC" SHEET
2,400 TONS
TERMINAL INSULATION
DISCS
WASHERS
RESISTANCE SUPPORTS, ETC.
HOUSE-HOLD APPLIANCES
15.3%
SPLITTINGS FOR STRATEGIC USES
(EST.) 5,411 TONS
ARMATURE WINDING-TAPE, ETC.
COMMUTATOR SEGMENTS
RINGS, CONES, ETC.
TRANSFORMERS
U.S. PRODUCTION - NONE
1.7%
RADIO SHEET
(EST.) 600 T.
CONDENSERS
TRIMMERS
SPARK PLUGS
RADIO TUBE BRIDGES
U.S. PRODUCTION EST. 75 TONS
U.S. TARIFF COMMISSION
MARCH-1940


11B
SOURCES OF STRATEGIC MICA BY COUNTRIES-1938-SHORT TONS
EXACT QUANTITIES OF STRATEGIC MICA BY COUNTRIES CANNOT BE ASCERTAINED
QUANTITIES SHOWN ARE ESTIMATES BELIEVED TO BE CLOSE, BUT VARY FROM YEAR TO YEAR
100%
WORLD PRODUCTION BLOCK OR BOOK MICA
9015 TONS
66.7%
FILMS AND SPLITTINGS
6013 TONS
33.3%
SHEET
3002 TONS
INDIA 5278 T.
58.7%
478 T.
4800 T.
MADAGASCAR 710 T.
7.7%
110 T.
600 T.
CANADA 25 T.
0.3%
INDIA 1055 T.
11.7%
705 T.
350 T.
BRAZIL 575 T.
6.4%
485 T.
90 T.
UNITED STATES 469 T.
5.2%
394 T.
75 T.
ARGENTINE 257 T.
2.9%
NORWAY AND SWEDEN 259 T.
2.9%
ITALY 134 T.
1.4%
AUSTRALIA 73 T.
CANADA 43 T.
MADAGASCAR 37 T.
PERU 27 T.
RUMANIA 25 T.
TANGANYIKA 24 T.
RHODESIA 19 T.
BOLIVIA 5 T.
TOTAL 253 T.
2.8%
85 T.
NON-STRATEGIC 818 T.
STRATEGIC MICA
NON-STRATEGIC MICA
U.S. TARIFF COMMISSION
APRIL 1940

NICKEL

Nickel in its pure form is a lustrous silvery-white metal, harder and stronger than iron, yet ductile and malleable. Its most important use is an alloying ingredient in steel to give increased hardness, toughness and strength. Nickel steel is highly important in the automobile and other industries where special steels are required. Stainless steels have a relative high content of nickel and chromium. Nickel also is an important alloy for copper, silver and aluminum. It is used as a catalyst and is extensively electroplated on other metals. Many of its military uses are identical with ordinary industrial uses. Strictly military uses are for armor plate, armor piercing projectiles, gun barrels, recoil cylinders, etc.

Over 85 percent of all nickel is produced in Canada principally in the Sudbury Basin. From a strategic point of view the United States is fortunate that such an abundant supply of this important metal has its source in a contiguous friendly country.

There are three principal ores, the most important of which is the <u>sulfide type</u>, composed of nickel, iron and sulphur and which makes up the bulk of the Canadian deposits where it is found associated with copper. The second type ore is <u>silicate</u> where the nickel is in the form of oxide combined with silicate. This is the type found in the New Caledonian deposits. The third type is <u>arsenical ore</u>, not comercially important at present.

In 1938 the United States produced 416 short tons of nickel as a by-product in electrolytic refining of copper. This, together with 2300 tons of secondary nickel recovered from scrap, is insignificant compared with our consumption for the same year - 22,400 tons, of which 80% came from Canada.

Principal producers of nickel ore in 1938 in metric tons of nickel content were:

Canada	95,559	Norway	1,125
New Caledonia	6,004	Burma	935
U. S. S. R.	2,500	Netherland India	500

QUARTZ CRYSTAL

Quartz or silicon dioxide (SiO_2) is one of the most common and widely distributed minerals. It is found in a variety of forms. The quartz crystal to which reference is here made, and which is meant when spoken of as a strategic material, is that particular crystal form having piezo-electric characteristics. The only developed source of this type is Brazil where it is almost exclusively produced. However, much of the Brazilian product is unsuitable for the use which good grade piezo-electric quality quartz crystal is applied - that of radio frequency control. For such use there are no satisfactory substitutes. Other uses of quartz crystal with less strict specifications are for jewelry, electrical apparatus, pivots and laboratory vessels.

The detection of imperfect crystals is a highly technical matter. Crystals for radio frequency control must be optically clear, have growth lines on 3 sides and must be free from flaws, cracks, ghosts, phantoms, veils, needles, bubbles and twinning. The detection of twinned crystals requires both precision instruments and experience. Good crystals must also meet certain diameter and length specifications. They sell for an average price of $6.00 per pound, although the price at times may be several times that figure. There is no domestic production of quartz crystal of a quality suitable for use in radio equipment.

The cutting of the mother crystal into smaller crystals for radio equipment used in the United States is done in the United States. It is a highly technical job as the radio crystal must be very accurately cut with reference to thickness and also in the directions of the various axes of the crystal. The average size of the finished radio crystal is about 1" x 1" x 1/10", but these dimensions vary with the frequency at which the crystal is to operate and to meet other conditions. The cutting is done by using carborundum on steel wheels, and for finer cuts diamond-tooth saws are used.

Production of Brazilian raw quartz in metric tons during the past few years as reported by the Bureau of Foreign and Domestic Commerce was:

1926	1927	1928	1929	1930	1933	1935
160	269	308	498	410	286	230

Only a small portion (about seven tons) of the gross production reported above is suitable for piezo-electric applications. By far the greater portion goes into jewelry, optical instruments, and drilling machinery. In 1935, the consumption of the Brazilian production by countries was:

Japan - 73% (predominantly for jewelry; some optical)
Great Britain - 13% (optical and radio)
Germany - 3.5% (largely for optical purposes)
United States - 2% (optical, industrial, jewelry and radio)
Holland - 0.4%
Remainder to China, France, Italy and Belgium

QUININE

"Many years of rainy seasons
And Malaria's countless treasons
Are among the many reasons
Why he's gone". J. S. Gilbert - Panama Patchwork.

Quinine is the best known, most generally accepted and used specific for prevention and treatment of malaria. Troops are dosed with it before, during and after exposure to known malarial conditions. Two synthetic compounds, atabrine and plasmochin have made great strides in the treatment of malaria but neither has completely displaced quinine.

Cinchona bark from which quinine is derived is graded into two classes, namely, "factory bark" and "pharmaceutical bark". The quinine is extracted from the bark by various processes and after purification is produced in the form of sulfate of quinine.

The world's production of cultivated cinchona bark and the manufacture of quinine extracted therefrom are now controlled by a combination of a group of planters in Netherland India and by a very small group of manufacturers in Holland. As 90 to 95 per-cent of the cultivated cinchona bark is grown in Netherland India, the control exercised by the combination is a very effective monopoly. Numerous attempts have been made and are still being made to break its power by growing cinchona bark elsewhere but up to the present such efforts have been without any degree of success. This organization operates as the Kina-Bureau and although it is not recognized in the United States because of this country's anti-trust laws, it does exercise control over our imports.

Some other countries which produce cinchona bark on a small scale but which make little imprint on the world supply of quinine are: Japan, British India, Bolivia, Peru, Brazil and the Philippine Islands. These, in general, are not self-sufficient for their own needs.

RUBBER

Our domestic rubber goods manufacturing industry is the largest in the world. In 1937 it employed 120,000 persons and had a total output value of $883,000,000. On a value basis crude rubber is about the most important single commodity imported into the U. S. Normally about 80% of our imports are used in the motor vehicle industry, 4% in rubber boots and shoes, and 16% for rubber hose, belts, druggists sundries and other miscellaneous products. The U.S. annually imports and consumes about a half million long tons of crude rubber - more than any other nation, or normally between 50 and 60% of the world production. In 1938, 98% of our imports came from the Middle East (60% from British Malaya and 26% from Netherland Indies).

Approximately 97% of the total output of crude rubber is produced in the Middle East - 52% in Malaya and other British possessions, and 33% in the Netherland Indies. A few American companies have plantations in British Malaya, Netherland Indies, Philippine Islands, Liberia, Brazil, Panama, Costa Rica and Mexico, but these holdings supply only about 6% of the rubber requirements of the U.S.

South America, the original home of the rubber plant, is often referred to as a source from which we may obtain our crude rubber needs were the trade routes to the East Indies and vicinity denied us in an emergency. The year of largest production of crude rubber in South America was 1912 when the output amounted to 49,000 long tons. Following the establishment of rubber plantations in the Middle East, the South American production declined rapidly and in 1938 amounted to only 15,000 long tons. Practically all the rubber produced in South America has been obtained from wild trees and it is unlikely that, even with high prices, production from wild trees will ever equal the output of 1912. The production of cultivated or plantation rubber in South America has been negligible, largely because of the South American leaf disease; however, it is reported this difficulty is gradually being overcome. It is unlikely that the South American production of plantation rubber will supply a significant part of the demand for rubber within the next decade. About 5 years are required for rubber trees to come into bearing, and considerable time is needed to prepare the land for planting. Another reason for the small production of rubber in South America, which has been advanced by many in the trade, is the higher cost of labor in that region as compared with the Middle East and the separate development of disease resistant plants. Plantation plants developed in the Middle East are not necessarily adapted to South American soil and environment.

There is a small production of crude rubber in Mexico, all of which is obtained from wild guayule, a rubber producing desert shrub, which also grows in the southwestern part of the United States. In 1912, the year of greatest output, Mexico produced 10,000 long tons of guayule rubber. The Mexican output declined after that year however, and in 1938, it amounted to only about 3,000 long tons, most of which was shipped to the United States.

If a shortage of crude rubber occurs, this country will undoubtedly use much greater quantities of reclaimed rubber. In normal times the consumption of reclaimed rubber amounts to about 140,000 long tons a year, but reclaiming plants operating at full capacity could produce considerably more. It is estimated that reclaiming plants operating at full expanded capacity could produce about 20 to 25% of our normal rubber requirements, i.e. providing scrap rubber continues available.

The synthetic rubbers and rubber obtained from guayule can be used in some cases as substitutes for imported crude rubber. At present the domestic production of synthetic rubber is small, and there is no commercial production of guayule rubber in this country. In the event of a shortage and higher prices of imported crude rubber, the production of these substitutes could be expanded, but probably from 1/ to 4 years would be required before the industries would be in a position to supply even minimum domestic needs. So far no all-purpose synthetic rubber has been developed. Certain of the synthetics are in some cases for special purposes better than crude rubber - particularly in the oil resistent fields; costs, however, at present far exceed that of the natural product.

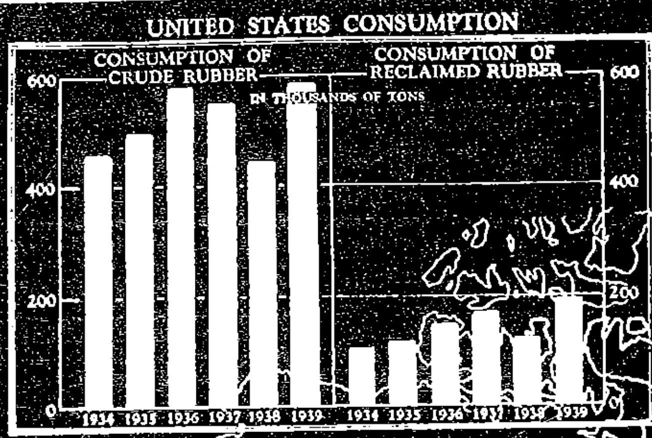
Rubber is indispensable in the manufacture of motor vehicles, airplanes, submarines, balloons, gas masks, electric motors, ships, railroad trains, street cars, electric lights, telephones, typewriters, printers' rolls, wireless apparatus, radios, medical goods, industrial fire and garden hose, orchard spray tubing, milking machines, athletic goods and several types of shoes. In addition, rubber is used but is not indispensable in the manufacture of many other commodities.

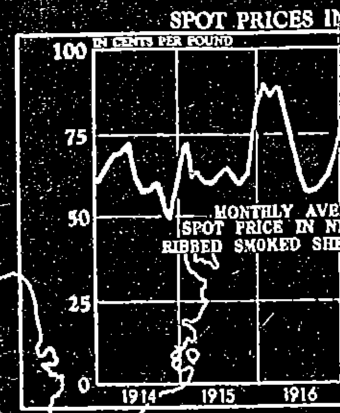
Stocks of crude rubber on hand in the U.S. vary from time to time. Rarely in the past several years have stocks exceeded 6 months' supply, generally they have been half that much. This in large part may be accounted for by the effects of the International Rubber Regulation Agreement which regulates production and export quotas of the signatory countries under British, Dutch, French and Siamese control. Over 95% of world rubber production is thus under regulatory control. Manufacturers of rubber goods in the United States are divided in their opinion concerning the restrictive agreement. Many are glad to have it in effect because it has enabled them to purchase crude rubber at a less variable cost and has removed somewhat the speculation on inventories. In the past, domestic manufacturers collectively have probably lost or gained as much as several million dollars in one month owing to changing prices. On the other hand, some dislike and are apprehensive of the "artificial device".

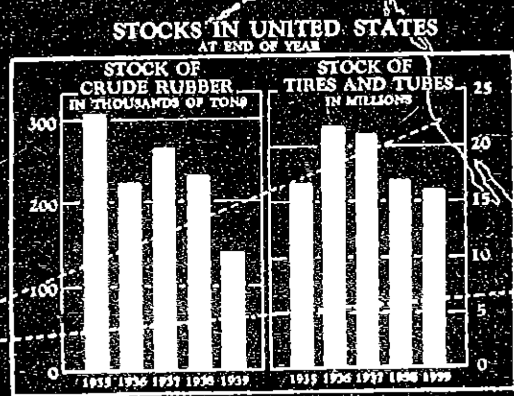
A national stock pile of rubber is being obtained as a result of an agreement of June 23, 1939 with the United Kingdom whereby approximately 600,000 bales of American cotton are to be exchanged for about 85,000 long tons of crude rubber. Deliveries are now being made. Plans have been made for the necessary rotation to prevent deterioration in storage. Storage is to be made at Government facilities in New York, Boston and other Eastern ports generally in relative proportion to the normal port receipts of this commodity in these localities. About four-fifths of U.S. rubber imports are entered on the Atlantic Coast.

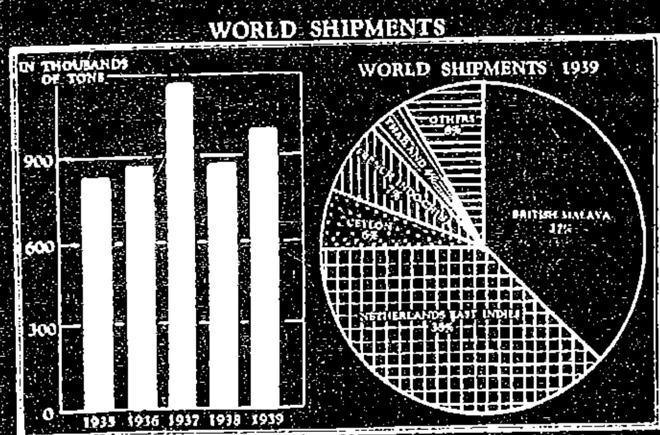
Further pertinent information is shown on a chart which follows.

RUB









TRANSPORT ROUTES FO

(IN THOUSANDS

	TOTAL IMPORTS	VIA PANAMA CANAL
YEARLY		
1933	418.9	3.0
1934	483.0	14.0
1935	467.1	76.6
1936	488.1	85.3
1937	600.5	79.9
1938	412.0	38.3
MONTHLY		
1939		
JAN.	37.1	2.4
FEB.	31.1	1.3
MAR.	45.7	1.6
APR.	32.0	1.9
MAY	45.9	2.3
JUN.	34.4	2.9
JUL.	37.4	1.7
AUG.	38.6	2.3
SEPT.	37.6	5.5
OCT.	45.6	3.3
NOV.	42.6	6.1
DEC.	71.4	32.2
1940		
JAN.	72.5	20.8
FEB.	49.1	11.7

*SHIPMENTS THROUGH SUEZ HAV
SOURCE: UNITED STATES DEPART

Compiled by COMMODITY
82 Beaver Street,

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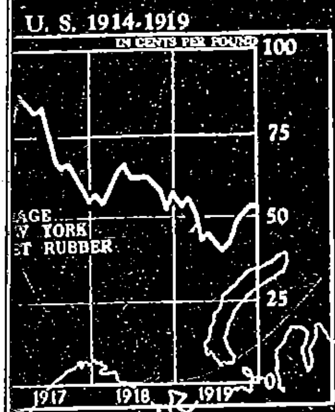
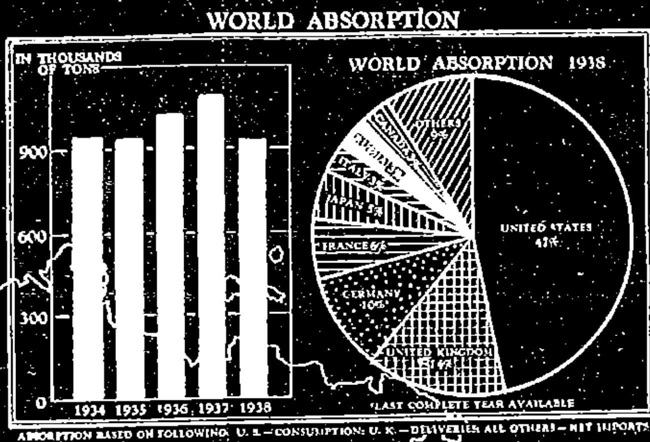
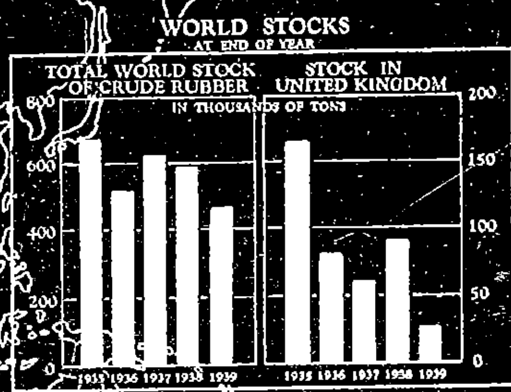




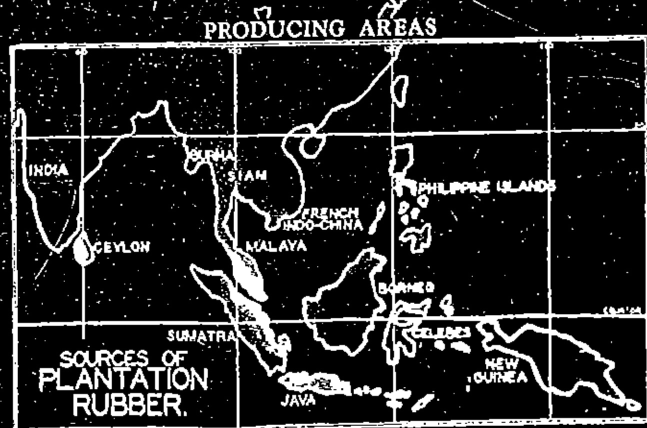


OR U. S. RUBBER IMPORTS

S OF LONG TONS)

INTO WEST COAST	ATLANTIC SOURCES	THROUGH SUEZ	AROUND CAPE OF GOOD HOPE
22.4	5.2	368.9	....
32.4	4.4	412.2	....
39.3	8.1	297.5	45.6
55.8	10.8	69.8	265.4
66.7	12.0	139.8	306.1
27.8	8.7	76.2	259.9
6.8	1.0	9.3	17.6
3.8	0.8	6.4	16.8
8.5	1.3	9.3	25.0
5.2	0.9	5.9	18.1
4.1	1.0	5.0	39.5
2.7	0.6	3.2	23.0
3.1	1.2	6.0	26.4
3.3	1.3	4.6	27.1
3.5	0.6	*28.0	
3.1	1.5	37.8	
5.7	1.8	29.0	
4.7	1.4	33.1	
6.7	1.0	44.0	
4.0	1.6	25.9	

VE NOT BEEN REPORTED SINCE AUGUST.
RTMENT OF COMMERCE.



Y RESEARCH BUREAU, Inc.
, New York City

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SILK

Silk is a material usually regarded as a luxury. In addition to its principal use for hosiery it has many uses in industry; the insulation of wire and cable is an example. In warfare it is used for the powder bags for large caliber guns and for parachutes. There is no domestic production of raw silk, although a number of attempts have been made to develop sericulture in the United States.

The development of substitutes has progressed to a remarkable extent; so much so that the silk problem in an emergency assumes lesser and lesser proportions as research and production of these substitutes increase. Completely satisfactory substitutes are now available for military uses of silk insofar as airplane and pyrotechnic parachutes are concerned. Substitutes for the use of silk in powder bags for large caliber guns, however, are not entirely satisfactory, particularly as far as the Navy is concerned where large caliber guns are operated in close quarters and under conditions requiring a clean and full burning powder container. Powder bag silk is made from waste silk not ordinarily used for high grade silken products. A fair sized stock of this type material is maintained by the armed forces. A large portion of waste silk, a by-product of our silk manufacturing industries, is generally exported. The domestic demand for this waste material does not, as a rule, absorb our production, hence it is exported, principally to Europe, where a better market exists.

The world's supply of raw silk comes principally from Japan and China and to a lesser extent from Italy and France. The United States consumes more than one-half of the world production. Annual production from all sources of raw silk usually is in excess of 100,000,000 pounds about three-fourths of which has its origin in Japan. China is the next largest producer. According to the Tariff Commission, we imported an average of about 55,000,000 pounds of raw silk per year during the 3-year period of 1936-38 practically all coming from Japan. China and Italy supplied a minor percentage of our imports.

TIN

The outstanding characteristics of this metal which make it essential to the arts and industries are its:

Ability to form thin, ductile, non-corrosive and closely adhering films or coating on steel and other metals.

Anti-friction properties.

Ability to act as a flux in binding one metal to another.

Tin presents one of our serious strategic mineral problems because the metal is indispensable for so many uses and there is virtually no domestic production even at exorbitant prices. It has become indispensable in the preservation of food, since it furnishes a protective coating on the steel from which our so-called tin cans are made. It is used in the manufacture of automobiles, for the making of bearings, solders, bronzes and gun metals. Tin can be rolled into foil and has many uses as a chemical. These uses could be reduced only to a limited extent by substitution. Only a minor part of our requirements in tin during an emergency period could be met by recovering tin from old scrap metals which have a tin content.

Under normal conditions the consumption of tin in the United States is 75,000 long tons annually or approximately 45 percent of world output. An analysis of U.S. tin consumption shows that percentages of use are as follows: tinplate 41, solder 22, babbitt 8, bronze 7, collapsible tubes 4, galvanizing, type metal, foil, tinning, terneplate and chemicals each approximately 2.

The world's principal producers of tin ore are the Malaya States, Netherland E. Indies, Bolivia, Siam and China. During the past five years 81% of foreign purchases was obtained from Asia, 18% from Europe and 1% elsewhere. Bolivian ore is sent to Europe for refining because there are no smelting facilities in the Western Hemisphere except one of small capacity in Argentina, and also because those ores have considerable impurities. At European refineries they are "sweetened" by mixing with other ores of purer content.

Tin among other important and high priority strategic materials is now being acquired for a national stock pile reserve. Domestic resources of virgin tin offer no hope whatever for emergency exploitation. Domestic production of tin during the period 1901-1938 has been less than 0.1% of our national consumption.

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TUNGSTEN

Tungsten is the heaviest of the base metals, its density being the same as that of gold. It has the highest melting point and highest modulus of elasticity of all the metals. Tungsten is an element required to give alloy steels high tension characteristics. In industry it is widely used for high speed tool steel, lamp filaments, non-ferrous alloys, electric contacts and electrodes, and also in the chemical industry for various uses. In the form of tungsten carbide it has still further uses. A strictly direct military use is as an alloy in armor piercing bullet cores.

Tungsten moves into consumption in this country principally in the form of ore or concentrates. It is marketed on the basis of a short ton unit of contained WO_3. A short ton unit is one percent of a short ton or 20 pounds.

Fortunately, tungsten does not offer as great a problem as some of the other strategic minerals mainly because we produce some of our needs, moreover molybdenum serves as a substitute in some uses including high speed tool steel. Normal annual consumption is estimated to be between 4,500 and 5,000 short tons of concentrates (60% WO_3). In the last 14 years the United States imported 50% more tungsten concentrates than it produced.

In 1938 the United States was apparently the second largest world producer, domestic output being the highest of record. The domestic tungsten industry, is protected by a tariff of 50 cents per pound tungsten content on imported ores and concentrates. China and Burma normally produce most of the world's tungsten ore. Other important foreign producers are Bolivia, Portugal, Malay States and Australia.

CRITICAL MATERIALS

ALUMINUM

Aluminum was formerly listed as a strategic material and placed in that category about the time the trend began toward its many industrial uses and the advent of the all metal aeroplane. The increased use of the metal, the supply of bauxite (the ore from which the metal is derived), the question of the adequacy of production and fabricating facilities, all tended to pose a problem of national sufficiency in a major emergency. After several years of research, and continued technical developments in that industry a thorough survey of materials and facilities matched against requirements reveals that no particular problem is presented.

The principal uses for aluminum are in the fields of air, land, and water transport equipment and general industrial and structural application in its many alloys, forms, shapes and castings. Its lightness and strength are prime factors influencing its use. Considerable aluminum is used in cooking utensils and many still today think of the metal primarily in connection therewith. Such use by no means constitutes its major industrial application no more than wire and nails could be said to be the principal product of the steel industry.

While our own reserves of bauxite are by no means small, for various economic reasons we normally import large amounts mostly from South America (British and Dutch Guiana). Of our metal imports Canada supplies the major portion and Europe the remainder.

WORLD PRODUCTION OF ALUMINUM AND BAUXITE IN METRIC TONS FOR 1938:

ALUMINUM		BAUXITE	
Germany	165,000	France	682,440
United States	130,100	Hungary	540,718
Canada	66,000	Yugoslovia	396,368
France	45,300	British Guiana	382,409
U.S.S.R.	43,800	Surinam	377,213
Norway	29,000	Italy	360,837
Switzerland	27,000	United States	329,015
Italy	25,800	U.S.S.R.	250,000
United Kingdom	23,300	Neth. India	245,354
Japan	17,000	Greece	179,886
All others	5,900	All others	117,760
Total 1938	578,800		3,862,000
Estimated Production 1939	647,400		4,400,000

*Source - Minerals Yearbook 1939 (revised figures of April 1940).

ASBESTOS

Asbestos is a mineral fiber. It is a general term applicable to any of several minerals which exist in fibrous form but which differ in chemical composition and in some physical characteristics. Asbestos is non-inflammable and is only slightly acted upon by acids. Its fibrous structure permits it to be spun into yarn or thread, woven into cloth, or felted into sheets of packings in the same way that a vegetable fiber may be treated, but unlike vegetable fiber it consists of inert, incombustible mineral matter and is, therefore, fireproof, weatherproof, and highly resistant to chemical action. Asbestos ore is generally quarried, the high grade ore being sorted out by hand.

Asbestos may be termed indispensable to modern life. As the chief constituent of brake-band linings and clutch facings it is essential to automotive transport; in the form of gaskets and packings it is a necessary part of steam-driven machinery; as a heat insulator it plays an important role in both household and factory construction and equipment; and combined with cement it is employed in the manufacture of vast quantities of roofing and other building materials.

The United States is the largest asbestos-consuming country in the world but produces only a small fraction of its requirements of raw materials. In 1938 sales from domestic production amounted to 6 percent of the quantity and 4 percent of the value of domestic requirements.

The volume of asbestos consumed in the U. S. depends primarily on two great industries - automobile manufacture and the building trades. The plotted consumption curve of asbestos has a definite relationship to those of automobile production and building construction.

Two of possible methods to be considered in meeting emergency needs were we denied imports are: (1) Stimulation of domestic production, which bears little promise; and (2) substitution of other materials for the major uses of asbestos which probably would be the main method utilized, thus freeing all available stocks for absolutely essential uses wherein substitutes are unsatisfactory. The building trade could well carry a large part of the substitute burden by the use of mineral, slag and glass wool and other substitutes should the necessity therefor arise.

In an emergency we would, if necessary, wholly or partially cease exports of manufactured asbestos products. Exports of such products for 1938 were valued at approximately $2,500,000 compared with imports of unmanufactured asbestos valued roughly at $6,000,000.

Canada is by far the world's greatest producer and supplies most of our imports. The U.S.S.R., Southern Africa and Cyprus are major producers. Some 18 other countries produce asbestos in varying amounts.

CORK

Cork in all its forms comes from the bark of an oak tree of which there are two species - (Quercus Suber and Quercus Occidentalis). For reasons which nature alone controls, this oak tree grows in commercial stands only in areas bordering the Mediterranean Sea and all attempts to establish cork forests in this country and elsewhere have thus far been unsuccessful. Much of the land on which the cork tree grows is two-crop land, the two principal crops being cork and pigs. The pigs root out the underbrush and are particularly fond of the cork oak acorns. Unlike our own oak trees, the cork oak is an evergreen, the leaves resembling our holly leaves minus the sharp points.

Virtually all of the physical properties of cork are based either directly or indirectly upon its unique cellular construction and it is these physical properties which account for its many various uses. The most important of the physical properties are buoyancy, compressibility, resilience, resistance to moisture and liquid penetration, frictional quality, low thermal conductivity, ability to absorb vibration, stability.

The world's supply of cork comes from a total area approximately the size of the State of New Jersey, stretching in a narrow belt for more than 1,000 miles along the northern coast of Africa and more than 1,500 miles along the coasts of Portugal, Spain and France. Annual world production is about 250,000 tons of raw cork of which the major producers normally are: Portugal 35%; Spain 30%; Algeria 15%. Owing to its great disproportion of bulk to weight, raw cork is generally shipped in mixed cargo vessels from the Mediterranean Area. A shipload of cork only would necessitate water ballast.

The cork industry in the U.S. with few exceptions is located on the Atlantic seaboard from Maryland to New York and involves chiefly five major production classes. These classes with approximate production value for 1937 are: cork stoppers and natural cork specialties, $3,500,000; cork insulation products, $6,770,000; cork composition and composition products, $5,100,000; cork tile $115,000; and cork marine goods, $130,000.

Cork is often broken into as many as 100 to 150 grades before it starts moving through a manufacturing plant from which it may emerge in almost endless varieties of products for use in connection with other products from automobiles to watches.

U.S. imports for 1938 were approximately 80,000 tons, representing about 40% of the world production. Owing to its many industrial and commercial uses a shortage of cork in a major emergency would entail serious difficulties. Even though substitutes are available and practical in a number of cases there are others whereby substitution might temporarily disrupt mass production practices or there may be a shortage of a particular substitution such as rubber, itself a stategic material. Conservation, substitution and at least some degree of control of cork stocks would be necessary in an emergency were we denied imports.

GRAPHITE

Sometimes called plumbago or black lead, this mineral consists of crystallized carbon. Chemically it is identical with the diamond but the widest of differences exist in physical characteristics between the two - one is the softest of minerals, the other the hardest.

Natural graphite may be either crystalline or amorphous. Crystalline or flake graphite is commonly understood to mean graphite in crystals of sufficient size to be visible to the naked eye; much of the so-called amorphous graphite shows a crystalline structure under the microscope, but its particles are small and its appearance is relatively dull. Crystalline graphite occurs either in veins, as in the Ceylon deposits, or as flakes disseminated in schists or other kinds of rock as in many of the deposits in the United States. Most deposits of amorphous graphite are the result of the alteration of coal beds by the intrusion of igneous rocks; amorphous graphite is also made artificially by means of the electric furnace. Some amorphous graphite marketed is contaminated with coal, coke, or other amorphous carbonaceous matter.

Graphite is used principally in the foundry and steel industry for linings, facing, and for core washes, and crucibles, for paints and pigments, pencils, crayons, commutator brushes, stove polish, in lubricants and for the manufacture of electrodes. Among the many uses to which high purity graphite, either of natural or artificial type, is especially well adapted may be mentioned brushes for electrical machines, special furnace blocks, carbon raiser (for raising the carbon content of steel), battery (dry-cell) graphite, electrotyping graphite and other grades used in brake linings, clutch facings, oilless bearings, graphite greases, rubber compounds and molds, powder glazing, boiler graphite and radio resistors. Military uses for graphite are principally for foundry and crucible work, paints and pigments, electrical machine brushes, electrodes and dry batteries.

Domestic supplies of graphite are drawn principally from Ceylon, Madagascar, Mexico, and Chósen. Canada normally supplies all our imports (usually less than 1,000 tons a year) of artificial graphite together with as much as 300 tons of flake and somewhat larger quantities of amorphous or ultra-small flake graphite. The world's largest sources of graphite are in Central Europe but the material is mostly too low-grade for export overseas. Actually graphite has been mined in almost every country in the world from Greenland (60 tons in 1937) to South Africa (69 tons in 1937); yet Ceylon and, in later years, Madagascar have been the only countries that have been able to get high enough prices for their raw graphite to permit it to be shipped to industrial nations all over the world. Even Korean (Chosen) graphite has a rather limited market and Mexican graphite, notwithstanding its purity, is all shipped to the United States. Of a total world output of 200,000 metric tons, the U.S.S.R. recently has been credited with furnishing over 40 percent; Germany and Austria combined, over 20 percent; Chosen, another 20 percent; and Mexico, 5 percent. Although the tonnage mined in Ceylon and Madagascar seldom exceeds 15 percent of the world's total, the value of their output is probably at least half of the world's total.

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HIDES

The hides and skins of various animals form the raw material from which leather is manufactured. The term "Hides" is applied to coverings of the larger animals; while, technically, "Skins" are derived from smaller animals. The intermediate size between a large "skin" and a small "hide" is known to the trade as a "kip". The term, however, is not very clearly defined; being used with various meanings in different parts of the world.

The heavier grades of hides are generally manufactured into sole and belting leather; those of extra large surface - "spready" hides - are often used for upholstery; and in some cases hides are split into several layers, or thicknesses, and by this means used for the production of boot uppers of a variety known to the trade as "Side Leather". As a general rule, hides, beacuse of their greater thickness, are particularly the raw material of the sole and heavy leather tanner, while skins go naturally into the process of making upper shoe, bag, and glove leather. These two industries are entirely separate and distinct.

The hides used by sole-leather tanners in this country are of both foreign and domestic origin. The chief sources of imported hides are the meat-freezing plants of South America, which in recent years have become a dominant factor not only in the world's supply of beef and mutton, but of hides and sheepskins as well. South American packer hides are known to the trade as "Frigerificos", and are preferred by many tanners over all other varieties. South American green-salted hides from smaller killing-plants are known as "Saladeros" and "Mataderos".

Of the many different hides, cattle hides constitute the bulk of the world's supply of hides and skins. They comprise at least 60 percent of the total international trade in hides and a much larger proportion of the annual production. Calf and sheep skins constitute an additional 25 percent of the total. The chief domestic supply is derived from the great meat-packing establishments of the Middle-West. "Packer" hides not only dominate the markets in this country, but exercise a strong influence on hide markets throughout the world. Quite a large supply also comes from the smaller abattoirs in various cities. Both "city" and "country" hides, which compare to "Saladeros" and "Mataderos", command a lower price than "Packer", because they are not as a rule so well taken-off or cured. All hides are bought and sold on a basis of so many cents per pound. They are classified by: (1) Geographical origin; (2) Take-off; (3) Weight and sex of the animal; (4) Freedom from defects.

With the exception of the heavy type hides principally used for sole leather, it is believed that no particular emergency problem will be encountered with the hide supply, since we are to a large degree self-sufficient in this item. Many substitutes are available and their use is growing rapidly. There is also a tendency towards decreased military leather requirements as harness and other animal transport equipment give way to mechanization.

IODINE

Iodine is a non-metallic element widely distributed in nature. It occurs in bluish-black rhombic plates, of metallic lustre, peculiar odor, acrid taste and neutral reaction; sparingly soluble in water, readily so in ether, and in alcohol, also in an aqueous solution of potassium iodide or sodium chloride. It volatilizes slowly at ordinary temperatures, and produces a dark-blue color with gelatinized starch in cold solution.

Iodine is largely used in medicine both externally and internally. Externally, it is used as an antiseptic in the form of tincture or in solution. It is also used as a germicide and counter-irritant. It is also used in many powders, and ointments. The tincture of iodine, by far the most popular, whether of alcoholic or aqueous solution, is cheap, easily prepared, convenient to use and above all highly effective. This combination makes iodine particularly well adapted as a general antiseptic. The salts of iodine, ammonium, potassium and strontium do not possess the germicidal qualities of the element itself, but are used internally as alteratives.

The commercial uses of iodine and the iodides are various and extensive. Small amounts of iodine are used as a chemical reagent in laboratory work and similar small amounts in various organic compounds and dyes, but the chief demand in the chemical field is in the production of the sensitizing solutions used in the manufacture of photographic films, plates and papers. Within the past few years considerable amounts of iodine have been added to cattle feed and to fertilizer for soils low in iodine.

Formerly sixty percent of the world's annual production of iodine was produced in Chile and twenty percent in Scotland. Relatively small amounts were produced in Japan, France and Java. World production and trade of iodine have undergone significant changes in recent years with the United States, formerly dependent upon a foreign monopoly for its supplies, emerging as the world's second largest producer, and capable of obtaining its entire requirements from domestic sources. The old method of obtaining this important item was from kelp, it is now produced in this country from salt brines obtained from abandoned oil wells. In 1930, prior to the utilization of domestic resources, the price of iodine was approximately $5.00 per pound. Since that time the price has gradually declined to around $1.60 per pound. This item, however, is being maintained on the critical list because of its high degree of essentiality and because the industry is young and it is felt that some difficulty may be encountered in maintaining domestic production to the degree necessary for emergency needs. There is no satisfactory substitute for this item for field use as an antiseptic for the armed forces.

KAPOK

Kapok is a vegetable down obtained from the seed pods of a widely distributed tropical tree which is indigenous to Southern Asia and the East Indies. Java is the leading center of commercial production. During recent years some kapok has been harvested and exported from the Phillipine Islands, where formerly the wild crop was allowed to go to waste.

Commercial Kapok is a soft, lustrous, inelastic fiber having a low specific gravity. It is too brittle for spinning; however, the cellular structure and shape of the fiber together with its low specific gravity renders it especially adaptable for use as a stuffing material for lifesaving equipment, pillows, mattresses and upholstered furniture. As a filler for lifesaving equipment it possesses marked advantages over other commercial fillers. Certain other tropical fibers, that is; pachote, red simal and balsa possess qualities which render them approximately as efficient as kapok for use in life preservers. However, these are neither produced in the United States, nor elsewhere in sufficient quantity of importance.

The estimated average annual world production for the year 1938 was 20,922 tons, of which the Dutch East Indies was the major producer. The United States imported 6,254 tons of kapok in 1938 and 9,379 tons in 1939.

The principal substitutes which can be used in lifesaving appliances are British Indian "Kapok" (an inferior product, not genuine kapok) and reindeer hair.

OPIUM

Opium is the coagulated milky exudate, obtained by incising the unripe capsule of the white poppy (Papaver Somniferum) an annual herb, indigenous to Asia, but cultivated elsewhere.

Crude opium is prepared in irregular lumps or cakes of dark brown color. There are some twenty alkaloids of opium of which morphine and codeine are the most important. Morphine has been classed as the most important drug in medicine for relieving pain. The drug is permanent and does not deteriorate, but finished preparations become unusable. However, the content of alkaloidal salts can be recovered with only the losses incident to processing.

The principal world sources are British India, Turkey, Asia and Yugoslavia. Importation is controlled by the Narcotics Division of the Treasury Department by allotting specified quotas to recognized importers. Shipping routes are via the Mediterranean and Atlantic sea lanes. Two-thirds of the imports are made in United States bottoms. In 1925 authority was granted the Surgeon General of the Army to accept and store in reserve, stocks of opium or preparations thereof, suitable for medicinal use which have been seized and confiscated by the authorities. At the present time the amounts received in this manner are considered sufficient for all military uses in a national emergency.

OPTICAL GLASS

This is another of the formerly strategic materials recently lowered to the critical list mainly owing to improved conditions and facilities for domestic production and to the accumulation of stockpile reserves.

Practically no optical glass and comparatively few optical instruments were manufactured in the United States prior to the World War. All our needs in military optical glass and instruments were of necessity supplied by importation because Europe, and particularly Germany, had a monopoly on the industry.

Optical instruments are essential equipment for the armed forces for no army or navy is properly equipped unless it is provided with an adequate supply of field glasses, cameras, fire control and range finding instruments, microscopes and lenses.

As the result of the intensive development and experimentation conducted between April 1917 and June 1918, we were at the end of that time manufacturing optical glass in sufficient quantity and quality to effectually meet essential requirements of the Army and Navy. At the end of August in 1918 there were five plants producing optical glass in sufficient output to meet military and naval needs.

Since the World War American manufacturers have had difficulty in successfully competing with foreign producers having sources of cheap skilled labor at their command.

With the advantage now obtained, namely, a 50 percent tariff on blanks and a correspondingly higher import duty on finished products, our domestic industries are furnishing approximately 50 percent or better of present peace time needs. However, conditions have been such in the industry that domestic production is not developed to a point where imports can be excluded.

While the situation of the United States is infinitely better at the present time than at the beginning of 1917, the acquisition of war reserves was considered necessary and the supply problem in any future emergency is thus minimized to the extent reserve stocks on hand will meet requirements until production facilities can be expanded.

PHENOL

Phenol (C_6H_5OH), sometimes called crystal carbolic acid or hydroxybenzene is a colorless, poisonous solid of characteristic odor. It is a natural coal tar product and is also produced synthetically. Its chief use is in the manufacture of synthetic resins and plastics. Other uses are for preservatives, antiseptics, solvents, dies and pharmaceuticals. An importnnt military use is in the manufacture of certain types of explosives used in quantity by the armed forces.

The increasing development of the plastics industry will require increasing production of phenol. From 1929 to 1933 the annual production of phenol increased from 24 million pounds to 33 million pounds, and in 1937 had doubled to reach an actual production of 65 million pounds. In 1938, the last year for which a full production return has been compiled, the output of phenol decreased to about 44½ million pounds, in accordance with general business conditions. The 1939 production was probably close to the 1937 output. Tendency in the industry is to favor the increasing development of facilities for manufacturing synthetic phenol, as against natural phenol. In contrast to conditions at the time of the World War, natural phenol is now considered as a reserve or additional source to supplement the production of synthetic phenol.

For civilian use, phenol is an important base for many phenolic resins, one of the oldest and most widely used of all the synthetic resin or plastic groups. For military purposes practically all of the required phenol is for the manufacture of amonium picrate, although primarily for the manufacture of picric acid. Phenol may be regarded as an intermediate product in the manufacture of picric acid, starting with the essential raw materials of benzene, sulfuric acid, nitric acid, caustic soda (and chlorine for the chlorobenzol process). Whether the picric acid is considered to be made by the phenol process or by the chlorobenzol method would determine whether there actually would be a substantial military requirement for phenol as such. The raw materials which would be required to make picric acid directly by the chlorobenzol process, would include those materials required to make phenol, although phenol itself would not be produced by that method. In thisrespect, there is actually no military substitute available for picric acid.

In 1938, from a total production of 44,500,000 pounds of phenol, about 35,000,000 pounds of phenolic (phenol-formaldehyde) resins were produced. This group constituted 34% of all coal tar resins and 28% of all synthetic resins produced in 1938.

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PLATINUM

Platinum is one of the rare and precious metals which has many uses in industry. It is necessary in the making of sulfuric and nitric acids and is used in many laboratory instruments, electrical contacts and in the dental and jewlery industries. In recent years Alaskan platinum production has shown phenominal increases. Output (chiefly placer platinum) has advanced progressively from 11,552 ounces in 1935 to 49,380 ounces in 1938. Chief world producers are Canada, about one half; U.S.S.R., South Africa, U. S. and Colombia in the order named. In the event of a shortage of platinum during an emergency, it is believed that a substantial amount could be obtained in the form of jewelry from the large domestic supply available in this form. A limited amount of platinum is still held in reserve from the supply acquired by the War Department in 1917-18.

TANNING MATERIALS

A tanning material is a substance possessing properties which will convert raw hide into a permanent, non-putrescible material, leather. The principal materials used in tanning are obtained from certain barks, woods, fruits, nuts, etc., which contain tannic acid. Certain metallic salts, such as chromium salts, are sometimes utilized in tanning; however, these are usally used in conjunction with vegetable materials.

The most important natural sources of tanning materials are: Roots conaigne; Woods - chestnut and quebracho; Barks - oak, hemlock, wattle, mangrove, and larch; Leaves - sumac. Of these materials chestnut, oak, hemlock, larch, sumac and conaigne are indigenous to the United States.

In general, tanning extracts are prepared by leeching tannic acid bearing vegetable materials with hot water. The resulting liquor, containing tannin, is condensed, usually in vacuum evaporators, until it contains twenty-five percent tannin. In this condition it is marketed as tannin extract. Some producers continue the evaporation until the extract is reduced to a solid or powder and market it in this form.

Domestic consumption is estimated to be in the neighborhood of 500,000,000 pounds annually of which approximately fifty percent is imported. Imports are due to the preference of tanners for foreign materials, either from quality or price considerations, or a combination of the two. The bulk of imports is derived from South America, mainly from Argentina and Paraguay. These imports are either in the form of commercial extracts or as raw materials to be extracted in this country.

Tannic acid made chemically and other synthetic materials have been placed in the market and tried by the tanning industry; however, none of these has proven as satisfactory as the materials obtained from vegetable sources. Continuous research is being conducted toward the development of a satisfactory substitute for the natural product.

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TOLUOL

Toluol ($CH_3C_6H_5$) is a clear transparent liquid with a characteristic aromatic benzol-like odor and a peculiar, disagreeable taste. That required for military purposes is almost entirely for manufacturing TNT (trinitrotoluene) which is made by nitrating toluol. TNT is the most important shell-filling high explosive used by the armed forces. Toluol has many chemical and other industrial uses such as the manufacture of intermediate chemicals, benzoic acid, pharmaceutical compounds, dye stuffs, rubber cements, stains and enamels, solvent for rubber; lacquers, varnishes, etc. The United States production of toluol was 16 million gallons in 1938.

Toluol may be obtained from bituminous coal and from petroleum. Methods of obtaining nitration-grade toluol from petroleum in commercial quantity have not yet been perfected, although a number of laboratory methods have been successful. Considerable progress may be expected in this respect from our progressive refining industry, particularly when demand warrants.

The peace-time supply of toluol is obtained entirely from by-product coke ovens, toluol production following closely the trend in production of pig iron since most of these ovens are used to produce the coke for making pig iron, and toluol with other coal derivatives are by-products.

While there appears to be a gradual increase in the use of toluol in the chemical industry the peace-time production probably will never be on a scale sufficient for war-time needs and for such needs there must necessarily be an expansion of production capacity. The quantity of toluol used as a raw material in the manufacture of chemicals is of the order of magnitude of 5 million gallons per year in times of good industrial activity. Approximately 15 million gallons per year are used as a solvent, largely in the manufacture of nitrocellulose coatings. This quantity to a large degree could be replaced, if necessary, by high aromatic material obtained from petroleum.

VANADIUM

This element is a metal widely distributed. It is found in commercial quantities in a limited number of operations, principally in four countries of which Peru normally is the most important. In 1938 the United States became the largest world producer. Greatly increased output in the Paradox Valley region in Colorado swelled the domestic total. The ores of vanadium most frequently found are carnotite, patronite, roscolite and vanadinite. United States production of vanadium contained in all types of ores from which it was recovered totaled 1,613,155 pounds in 1938 compared with 1,086,125 pounds in 1937. Despite the large increase in domestic production imports for consumption in this country increased. Imports were 1,384,320 pounds in 1938.

Ferrovanadium is used in the manufacture of steel alloys. The metal is also alloyed with copper. Salts of vanadium are used to color pottery and glass, and also are used as mordants in dyeing. "Red Coke" or crystalline vanadium oxide is used as a catalyst in the preparation of vanadium compounds.

WOOL

Wool is the most important animal fiber, and the health and well-being of both the civilian population and the armed forces depends to a considerable extent upon the supply of this material. In normal times we import a considerable supply from the countries of Europe and from Argentina, Uruguay, Australia, South Africa and Canada. In time of war, both our Army and Navy are clothed in wool. Without imports there would be serious shortages of this material. The principal military uses of wool are in the manufacture of clothing, blankets, felt, horse equipment, bunting and flannel.

During 1939 we imported 98,193,000 pounds of apparel wool while producing 441,897,000 pounds during the same period. One of the main military uses for wool is in the supply of uniforms. These should be available as fast as personnel for the armed forces is mobilized. Woolen cloth must be available before manufacture can start. At least 90 days will be required to convert the necessary raw wool into cloth unless a sufficient supply of uniform cloth is available at the beginning of any emergency. It is very doubtful that such will be the case for a major emergency mobilization. Ways and means are being considered for the purpose of providing a reserve of suitable woolen cloth. Such a reserve could be rotated by current military use from this reserve replacement being made at the time with new cloth purchased from annual appropriations provided for uniform cloth for the regular establishment.

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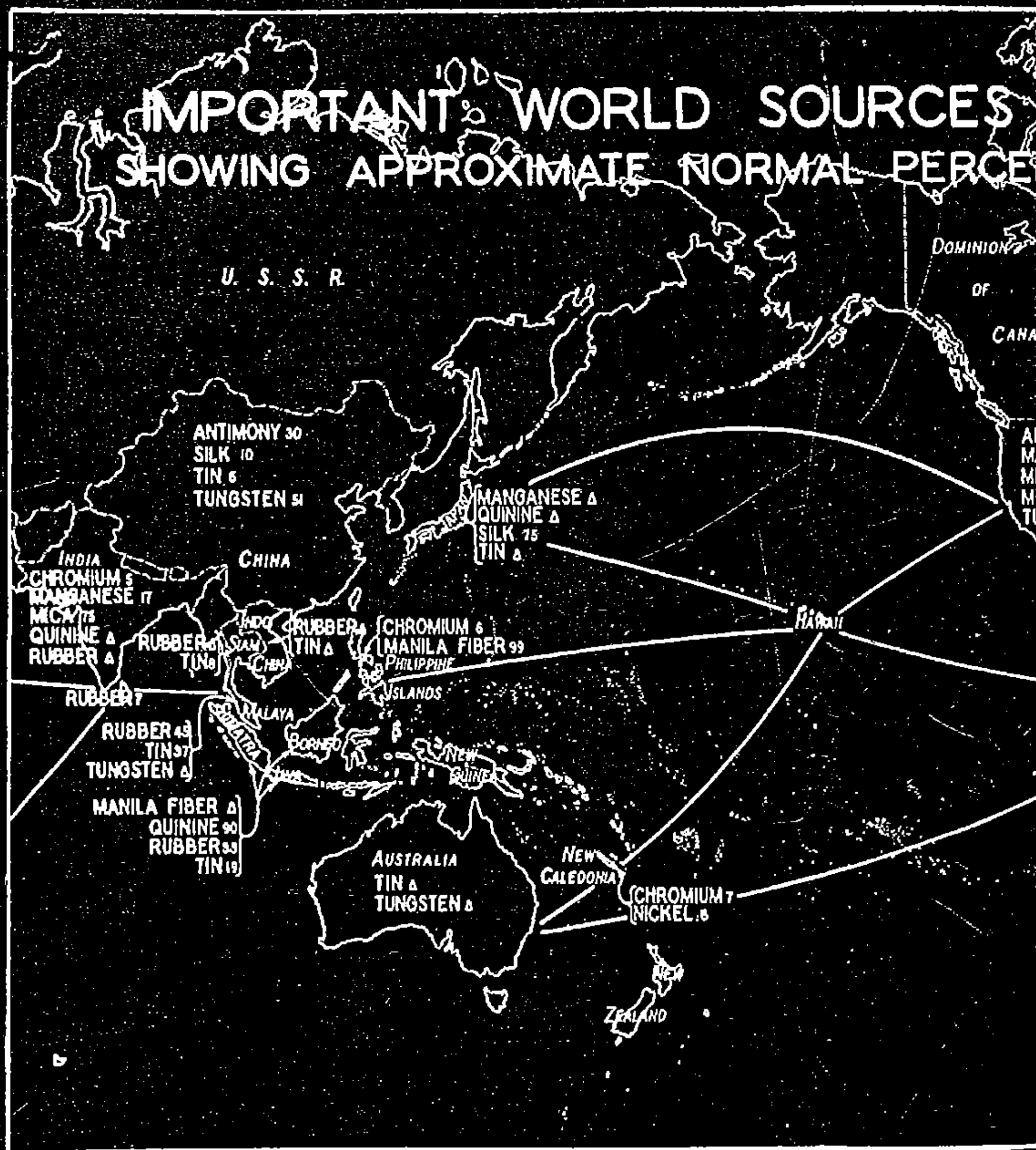
OTHER MATERIALS

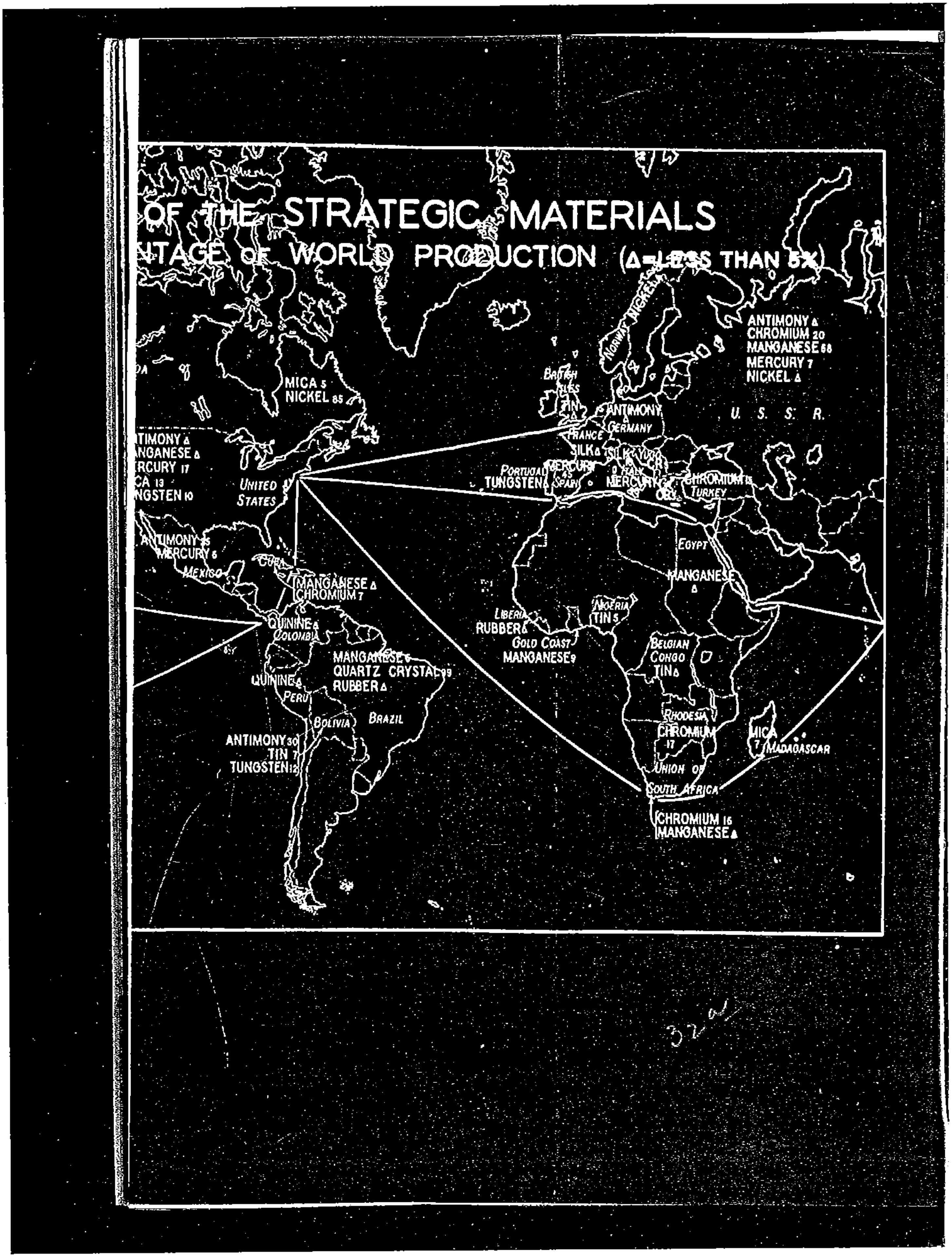
Those materials which were frcmerly known as "Materials Neither Strategic nor Critical", or at times loosely called "Essential Materials", together with those which have been dropped from the higher priority lists, are now maintained under observation and surveillance by the Board. Studies, statistics and other data are kept up on these materials. Trends in production and uses are watched and the Board is kept advised and in touch with new conditions and developments in respect to these and such new materials that may come into industrial use.

Two additional metals have been added to this list. They are beryllium and cobalt, neither of which is produced in quantity in the United States. Some of the more important of the materials maintained under continued surveillance are: abrasives, acetone, ethyl alcohol, molybdenum, magnesium, nitrogen compounds, refractories, uranium and zirconium.

* * * * * * * * * * * *

An outline world map showing some of the sources of the strategic materials is attached as a supplement to this pamphlet. The given figures showing percent of world production are approximate and are intended to indicate an average for the past several years. Local or world conditions may change percentages materially from year to year under varied circumstances, but as a whole they are considered typical under average conditions. United States mica production as shown includes all mica except scrap and waste.


IMPORTANT WORLD SOURCES
SHOWING APPROXIMATE NORMAL PERCE
U. S. S. R.
DOMINION
OF
CANA
ANTIMONY 30
SILK 10
TIN 6
TUNGSTEN 51
CHINA
INDIA
CHROMIUM 5
MANGANESE 17
QUININE Δ
RUBBER Δ
MANGANESE Δ
QUININE Δ
SILK 75
TIN Δ
RUBBER
TIN Δ
CHROMIUM 6
MANILA FIBER 99
PHILIPPINE
ISLANDS
HAWAII
SIAM
MALAYA
SUMATRA
BORNEO
NEW GUINEA
RUBBER 45
TIN 37
TUNGSTEN Δ
MANILA FIBER Δ
QUININE 90
TIN 19
AUSTRALIA
TIN Δ
TUNGSTEN Δ
NEW CALEDONIA
CHROMIUM 7
NICKEL
NEW ZEALAND


OF THE STRATEGIC MATERIALS
NTAGE OF WORLD PRODUCTION (Δ=LESS THAN 5%)
ANTIMONY Δ
CHROMIUM 20
MANGANESE 68
MERCURY 7
NICKEL Δ
U. S. S. R.
MICA 5
NICKEL 85
NORWAY NICKEL Δ
BRITISH ISLES
TIN Δ
ANTIMONY Δ
GERMANY
FRANCE
SILK Δ
PORTUGAL
TUNGSTEN Δ
SPAIN
ITALY
MERCURY
CHROMIUM 15
TURKEY
TIMONY Δ
NGANESE Δ
RCURY 17
CA 13
NGSTEN 10
UNITED STATES
ANTIMONY 35
MERCURY 6
MEXICO
CUBA
MANGANESE Δ
CHROMIUM 7
QUININE Δ
COLOMBIA
MANGANESE 6
QUARTZ CRYSTAL 99
RUBBER Δ
QUININE Δ
PERU
BOLIVIA
BRAZIL
ANTIMONY 30
TIN 7
TUNGSTEN 12
EGYPT
MANGANESE
Δ
LIBERIA
RUBBER Δ
GOLD COAST
MANGANESE 9
NIGERIA
TIN 5
BELGIAN CONGO
TIN Δ
RHODESIA
CHROMIUM
17
UNION OF SOUTH AFRICA
MICA
7
MADAGASCAR
CHROMIUM 16
MANGANESE Δ

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Asbestos Substitutes Reference

EXHIBIT 5

TO DECLARATION
OF REAR ADMIRAL BEN J. LEHMAN (RET.)

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TITLE 32 - NATIONAL DEFENSE

CHAPTER IX - OFFICE OF PRODUCTION MANAGEMENT

Subchapter B - PRIORITIES DIVISION

Part 1064 - ASBESTOS

CONSERVATION ORDER NO. M-79 CURTAILING THE USE OF CERTAIN TYPES OF ASBESTOS

WHEREAS, National defense requirements have created shortage of certain types of asbestos for the combined needs of defense, private account, and export; and the supply now is and will be insufficient for defense and essential civilian requirements unless their use in certain products manufactured for civilian use is curtailed; and it is necessary in the public interest, to promote the defense of the United States, to conserve the supply and direct the distribution thereof;

NOW, THEREFORE, IT IS HEREBY ORDERED THAT:

1064.1 (a) Restrictions on the Use of Certain Types of Asbestos

(1) Unless otherwise specifically authorized by the Director of Priorities, after February 1, 1942, no person shall fabricate, spin, or process in any other way asbestos fibre imported from South Africa except where such fabrication, spinning or processing is necessary to fill Defense Orders as defined in Priorities Regulation No. 1, as amended from time to time.

(2) In addition to the above limitation, unless otherwise specifically authorized by the Director of Priorities, after February 1, 1942, no person shall fabricate, spin, or process in any other way:

(i) Chrysotile asbestos fibre (Rhodesian Crade C and C-1 and 2 except where such fabricating, spinning or processing is necessary to fill Defense Orders for:

(a) Core rovings to meet Navy specification Number 17-1-20 (INT); (Insulation, electrical, asbestos fibre, treated and untreated, dated October 1, 1941, or as same may be amended.)

(b) tapes and cloth which are required by specification to be of non-ferrous nature.

(c) non-ferrous lapps.

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(ii) Amosite asbestos fibres (Grade B-1 or amosite asbestos having a fibre length equivalent to that of Grade B-1) except where such fabricating, spinning or processing is necessary to fill Defense Orders for Amosite woven felt blankets and mattresses for turbine insulation for use on naval and maritime ships.

(iii) Amosite asbestos fibre (Grade B-3, D-3) or amosite asbestos having a fibre length equivalent to that of Grade B-3 or D-3) except where such fabricating, spinning or processing is necessary to fill Defense Orders for:

(a) Woven Felt blankets and mattresses and fittings for turbine insulation for use on naval and maritime ships;

(b) Fire proof board;

(c) Sprayed Amosite;

(d) Eighty-five per cent magnesia pipe covering and blocks;

(e) Molded Amosite pipe covering and blocks

(f) Flexible amosite pipe insulation

(g) Dry pack insulation.

(3) In addition to the above limitations unless otherwise specifically authorized by the Director of Priorities, after February 1, 1942, no person shall install eighty-five per cent magnesia or other high temperature pipe covering except in installations where temperatures of 200° Fahrenheit or over occur.

(b) Reports

(1) Any person who manufactures or processes asbestos fibre shall, on or before the 10th day of February, 1942, and on or before the 10th day of each calendar month thereafter, file with the Office of Production Management, Ref: M-79, all of the information required by Forms PD-251 and PD-252, whichever is applicable.

(2) In addition, any person who manufactures or processes asbestos fibre shall, when requested, file with the Office of Production Management, Ref: M-79, all the information required by Form PD-253.

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limiting or curtailing to a greater extent than herein provided, the use of asbestos fibre in the production of any article, the limitations of such other Order shall be observed.

(4) Correspondence and Communication. All reports to be filed hereunder, and all communications concerning this Order, shall, unless otherwise directed, be addressed to:

"Office of Production Management
Washington, D. C. Ref: M-79"

(5) Violations. Any person who wilfully violates any provision of this order, or who by any Act or Omission falsifies records to be kept or information to be furnished pursuant to this Order, may be prohibited from receiving further deliveries of any Material subject to allocation, and such further action may be taken as is deemed appropriate, including a recommendation for prosecution under Section 35 A of the Criminal Code (18 U.S.C. 80).

(6) Effective Date. This Order shall take effect immediately and shall continue in effect until revoked.

(P.D. Reg. 1, Amended, Dec. 23, 1941, 6F.R.6680; O.P.M. Reg. 3 Amended, Sept. 2, 1941, 6F.R. 4865; EO. 8629, Jan. 7, 1941, 6 F. R. 191; E.O. 8875, Aug. 28, 1941, 6 F. R. 4483; sec. 2 (a), Public No. 671, 76th Congress, Third Session, as amended by Public No. 89, 77th Congress, First Session).

Issued this 20th day of January, 1942.

(Signed) J. S. Knowlson

J. S. Knowlson
Acting Direcotr of Priorities

OFFICE OF PRODUCTION MANAGEMENT

Division of Priorities

For immediate release
January 21, 1942

PM 2262

South African asbestos has been placed under strict control by the Director of Priorities, who issued Conservation Order M-79 curtailing the used of certain types of asbestos. It takes effect immediately.

The order prohibits the use of South African asbestos after February 1, except to fill defense orders, and permits its use to fill defense orders for specified purposes only.

Unless specifically authorized by the Director of Priorities, after February 1, no one shall process any Chrysotile asbestos fiber unless necessary to fill defense orders for core roving or non-ferrous tapes, cloth and lapps.

Prohibitions are also placed by the order on processing Grade B-1 amosite asbestos fiber except to fill defense orders for woven felt blankets and mattresses for marine turbine insulation. Nor shall anyone process Grade B-3 or D-3 amosite asbestos fiber unless to fill defense orders for turbine insulation blankets, fire-proof board, sprayed amosite, welded amosite pipe covering and blacks, 85 per cent magnesia pipe covering, flexible amosite pipe insulation or dry pack insulation. The order prohibits installing without specific authority any high temperature pipe covering unless used where temperatures of over 200 degrees fahrenheit occur.

The order states that anyone processing asbestos fiber should file all information required on form PD-251 or PD-252 and return it to OPM by February 10, 1942, and by the tenth of every calendar month thereafter. When OPM requests it, any asbestos processor must fill out and return form PD-253

314

SUPERVISOR OF SHIPBUILDING, U. S. N.
ORANGE, TEXAS

File Nod-1512/S39(3228) 21 February 1942

To: Bureau of Ships

Subject: DD569-580; Insulation; Substitution of Fiberglas for Amosite Blankets; Proposal for.

Reference:

(a) OSC ltr. file DD569-580/S39(200) dated 14 February 1942.
(b) OSC ltr. file DD569-580/S39(200) dated 18 February 1942.

Enclosure: (Herewith)

(A) Copy of reference (a), with its enclosures.
(B) Copy of reference (b).

1. References (a) and (b) propose substitution of fiberglas for amosite in portable blankets for valves and fittings on high pressure auxiliary steam lines, low pressure auxiliary steam lines, auxiliary exhaust, miscellaneous low pressure, low temperature pipe lines and on the main steam lines, quoting as authority certain O.P.M. news releases, conservation orders and letters, copies of which are attached to enclosure (A).

2. This office has received no instructions prohibiting the use of amosite other than those supplied by the contractor.

3. The contractor also proposes to substitute hair felt for hot fresh water systems, in lieu of woven asbestos fibre, as set forth in reference (b).

4. The Bureau is requested to advise as to what substitutions are now necessary and to advise of the approved substitutes.

R. B. Perry.

Copy to:
OSC
Design Division, Development Section.

Case 4:19-cv-00326-DMR Document 1-1 Filed 01/18/19 Page 194 of 354

DDR 833 – INSUL

EXHIBIT
Cushing-29
7/7/04 ES

PTB:SF
3/10/43

DD44601aaa/S39-1(614)

VIA AIR MAIL

MAR 10 1943

From: The Chief of the Bureau of Ships.
To: The Supervisor of Shipbuilding, USN., Orange, Texas.

SUBJECT: Destroyers – DD575-580 – Lagging of Deaerating Feed Tanks and Evaporators.

1. Confirming information furnished Commander H.G. Chalkley, USN., during his visit to the Bureau of Ships on March 10, 1943, the use of cotton duck lagging in lieu of asbestos cloth for deaerating feed tanks and evaporators is hereby authorized.

2. The cotton duck should be in accordance with Type B Bureau of Ships Specification 24D3(INT). After installation, a two-coat fire retardant treatment shall be applied by brushing or spraying, using one of the following mixtures:

(a) Boric Acid (H_3BO_3) - - - - - - - - - - - - - 50 percent
Sodium alginate - - - - - - - - - - - - - 1 percent
Water - - - - - - - - - - - - - 49 percent

followed when thoroughly dried by one finish coat of fire retardant paint, Bureau of Ships Specification 52P22(INT) as amended, to prevent moisture from leaching out the fire retardant mixture.

(b) Sodium Silicate Solution - - - - - - - - - 31.0 percent
(sp.gr. 1.41 to 1.42, silica soda ratio 3.3 to 3.4)
Kaolin - - - - - - - - - - - - - - - - - - 41.4 percent
Water - - - - - - - - - - - - - - - - - - 27.6 percent
No fire retardant paint is necessary.

Copy to:
Cdr. H.G. Chalkley
648
646
356

3111014

E. Burton
By direction

[illegible]

2. [illegible] as outlined in paragraph [illegible] in vessels [illegible] therefrom [illegible] to issue a formal change [illegible] contract upon receipt of information as to vessels involved [illegible] work to be [illegible]

3. [illegible] in subject vessels [illegible] reference (a) [illegible] in reference (b) and (c), Work Change [illegible] is hereby assigned. This change [illegible] units.

4. The contractor's estimate for [illegible] man-hours [illegible] and (e). [illegible] the contractor's [illegible] agreements [illegible] and the [illegible]

[illegible]

2171214

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AN ADMINISTRATIVE HISTORY OF THE BUREAU OF SHIPS DURING WORLD WAR II

VOLUME IV

FIRST DRAFT NARRATIVE
PREPARED BY THE HISTORICAL SECTION
BUREAU OF SHIPS

linoleum, marine plywood for emergency repairs and for a large number of applications where fire and water are destructive elements.

Shark Repellent Kit A material for the protection of personnel from attack by sharks has been developed. A water soluble material and a chemical have been combined and enclosed in a unit designed to attach to the individual users life jacket. The unit has a quick opening device for immediate use.

Salt Water Soap and Laundry Methods Conservation of fresh water aboard all ships is of major importance. As a large amount of water is required for use by the ship's laundry, a salt water soap and instructions for its use in laundry practice has been developed which saves from 5,000 to 7,000 gallons of fresh water per day on a cruiser class ship.

Mess gear of High Impact Strength Glass and china tableware suffer considerable damage from shock due to gun firing. Tableware made of glass and of plastic material has been developed which reduces this breakage to a minimum under battle conditions of today.

Asbestos-Glass Insulation Lagging Cloth A shortage of asbestos fiber and facilities for weaving cloth necessitated development of an alternate. By twisting an asbestos yarn around a glass yarn, a glass-asbestos yarn was produced which actually produced a better and more workable cloth of about 1/2 the weight and which used about 1/2 the asbestos used in the Standard asbestos cloth.

Resin-Bonded Bearing Strips. Lignum Vitae has been the standard bearing material for stern tubes for years. A natural rubber bearing strip was found to be more satisfactory than wood, but the shortage of natural rubber necessitated an alternate for rubber bearing strips or going back to wood. The resin bonded materials were developed and have given satisfaction.

Affidavit of Samuel A. Forman, M.D.

EXHIBIT 6

TO DECLARATION
OF REAR ADMIRAL BEN J. LEHMAN (RET.)

Case 4:19-cv-00326-DMR Document 1-1 Filed 01/18/19 Page 199 of 354

AFFIDAVIT OF SAMUEL A. FORMAN, M.D.

COMMONWEALTH OF MASSACHUSETTS)
) ss.
COUNTY OF MIDDELSEX)

I, Samuel A. Forman, M.D., being under penalty of perjury, declare and say:

1. I am a medical doctor specializing in preventive medicine and occupational medicine. I received a B.A. degree from the University of Pennsylvania majoring in history and biology, graduating *magna cum laude* in 1973. I attended Cornell Medical School, graduating with an M.D. degree in 1977. I also received a degree in public health in 1977 as a result of a joint program with the Harvard School of Public Health. Thereafter, I became board certified in occupational medicine after attending a residency at the Harvard School of Public Health.

2. In 1977, I went on active duty in the United States Navy, and I performed my internship at the Bethesda Naval Medical Center in Bethesda, Maryland during 1977 and 1978. I remained on active duty in the Navy until 1983. Thereafter, I continued to work for the Navy as a civilian employee until 1986. My qualifications and credentials are more fully described in my curriculum vitae, a copy of which is attached as Exhibit A.

3. While on active duty in the Navy, I ran an occupational health clinic at the Naval Weapons Station at Seal Beach, California, and assisted in the medical programs at the Long Beach Naval Shipyard. Among other responsibilities, I assisted in the asbestos medical surveillance program for over 2,000 employees. At any one time, I was following 200 cases of asbestos disease.

4. In 1982, I was assigned to the Naval Environmental Health Center at Norfolk, Virginia. While stationed there, I designed occupational medicine programs with regard to Navy-specific occupational diseases, performed health hazard evaluations, inspected the occupational health programs of government facilities as part of the NAVOSH program, carried out epidemiologic studies, and trained Navy doctors and nurses in occupational medicine.

5. In 1983, a Navy JAG officer for the Naval Medical Command requested that I become part of a team to locate, digest and organize government documents for production in asbestos litigation. Over the next year and a half, I investigated the Navy's historical handling and knowledge of various industrial hygiene issues, including asbestos disease.

6. In 1985, pursuant to Navy orders, a copy of which is attached as Exhibit B, I completed my review of Navy knowledge and practice in industrial hygiene, including its awareness of and response to health hazards of asbestos, as a formal assignment. My search for documents took me to the National Archives, other warehouses and storage facilities for record of the Navy's Bureau of Medicine and Surgery. I was given full security clearances for and access to these facilities. I also conducted research at private facilities such as Harvard University's Countway Library of Rare Books.

7. Following my research, I published an article entitled "U.S. Navy Shipyard Occupational Medicine Through World War II" in the *Journal of Occupational Medicine*, Vol. 30, No. 1 (Jan. 1988). A copy of that article is attached as Exhibit C.

8. On the basis of my research for and regarding the Navy, I concluded that the Navy's occupational health programs have paralleled, and at times led, the development of occupational medicine and industrial hygiene with respect to asbestos-related disease. From my review of countless Navy documents and my studies while employed by the Navy, I acquired extensive knowledge as to the state of Navy knowledge and awareness regarding the hazards of asbestos. Based upon that review, I conclude that the Navy's knowledge in these areas was quite complete when compared to available knowledge at the time, and that by 1940 the Navy was a leader in the field of occupational medicine relating to, among other things, asbestos exposure.

9. Based upon my review, I am aware that the Navy knew by 1922 that asbestos exposure was a potential health hazard, and that its knowledge and awareness continued to develop throughout the following decades. This development is evidenced by, among numerous other documents, the following:

a. Louis I. Dublin, Ph.D., et al., "Instructions to Medical Officers," U.S. Naval Med. Bull. 17:883, 885-86, 897-899 (1922) (listing "Asbestos workers" among "Hazardous Occupations"). The document, a copy of which is attached as Exhibit D, originated from the Division of Preventive Medicine of the United States Navy Medical Corps.

b. Handbook of the U.S. Navy Hospital Corps (1939) (workplace inspection checklist includes: "What precautions are exercised to prevent damage from pipe covering compounds? What asbestos hazards exist?"). A copy of this document is attached as Exhibit E.

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c. Annual Report of the Surgeon General of the United States Navy (1939) (describing asbestosis as "an industrial disease of the lungs incident to inhalation of asbestos dust for prolonged periods" and noting risk "continued exposure to present occupational conditions"). A copy of this document is attached as Exhibit F.

d. Ernest W. Brown, M.D., "Industrial Hygiene and the Navy in National Defense," *War Medicine*, vol. 1, 3, 11-12 (1941) (listing asbestosis among "chief occupational health hazards in navy [ship]yards" to "workers engaged in the manufacture of asbestos insulating covers" and describing appropriate measures for control of asbestos exposure). The author of the document, a copy of which is attached as Exhibit G, was a Captain in the Navy Medical Corps.

e. U.S. Navy Department, U.S. Maritime Commission, "Minimum Requirements for Safety and Industrial Health in Contract Shipyards" (Jan. 20, 1943) (describing sources of asbestos exposure and listing appropriate precautions). The document, a copy of which is attached as Exhibit H, was approved by the Navy, and an introduction was co-signed by Secretary of the Navy Frank Knox.

f. U.S. Navy *Safety Review*, Vol. 4, No. 1 (Jan. 1947) ("[e]xposure to asbestos dust is a health hazard which cannot be overlooked in maintaining an effective industrial hygiene program"). A copy of this document is attached as Exhibit I.

10. All of my opinions set forth herein are held to a reasonable degree of scientific certainty.

Samuel A. Forman, M.D.

Sworn to and subscribed
before me this 23rd day
of June, 2005.

NOTARY PUBLIC

DEMETRIO S. FRANCISCO
Notary Public
Commonwealth of Massachusetts
My Commission Expires
June 2, 2011

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EXHIBIT A

SAMUEL A. FORMAN, M.D.
One Research Drive
Suite 301B
Westboro, MA 01581

(508)-948-6010 (508)-948-6095 fax (617)-945-9645 home
sforman@statusone.com email

EMPLOYMENT

2005 – present

Consultant, Cambridge, MA
Expertise in population-based case management, disease management, predictive modeling, proposal writing, professional publications, toxicology, and general management of health-related enterprises.

1997 - 2004

StatusOne, Westboro, MA
Senior VP, Chief Medical Officer and Co-founder
Services, consulting, software and Internet services helping risk-bearing health organizations care for their frailest members. Develop predictive models, organize and execute medical management services, formulate client relationships, contribute professional papers and monographs, evaluate competitive offerings, and represent StatusOne to medical audiences. A Principal Investigator of the CMS Medicare Coordinated Care Demonstration with Washington University Physician Network. Led proposal writing for American Healthways CMS contracts.
StatusOne is an American Healthways Company since September 2003.

1995 - 1997

Blue Cross and Blue Shield of Massachusetts, Boston, MA
Medical Director, Clinical Improvement
General management responsibilities for pharmacy, home care, and several health care joint ventures. Lead clinical improvement projects involving all specialties in a 100,000 member integrated delivery system. Provide general internal medicine care.

1986 - 1993

Procter & Gamble Company, Cincinnati, Ohio
Consultant, later Associate Director, Occupational Health
Manage U.S. self-insured health programs for 30,000 employees comprising the detergent, paper, pharmaceutical and food divisions. Build epidemiologic function, design, contract for, and execute studies. Model programs reapplied worldwide. Manage 5 physicians, 3 nurses plus support staff. Deliver clinical services to technical center staff and senior management. Direct 70 site clinics and 60 part-time physicians.

1984 - 1986

Coastal Emergency Services, Inc., Virginia
Clinical services in emergency and general internal medicine.

MILITARY SERVICE

1982 - 1986

Navy Environmental Health Center
Norfolk, Virginia
Lieutenant Commander, later GS-14 Consultant in the occupational medicine division
Set standards, review complicated disability claims, apply statistical methods to health care delivery, inspect clinics for QA and UR, lecture on professional topics, perform epidemiologic studies and health hazard evaluations, manage development and implementation of clinical information management system.

1980 - 1982

Naval Regional Medical Center
Long Beach, California
Occupational Medicine Service; Head, Seal Beach Naval Weapons Station clinic. General and occupational clinical and preventive programs for personnel at conventional, nuclear capable, and special weapons industrial base. Manage asbestos medical surveillance program at Long Beach Naval Shipyard.

1978 - 1979

USS St. Louis (LKA-116) and **USS Duluth** (LPD-6)
Based at San Diego, California
Ship's physician
Western Pacific operations, general office and emergency practice. Vietnamese refugee assistance.

EDUCATION

1993 - 1995

Yale University School of Management,
New Haven, Connecticut
Master of Business Administration
Concentration in Organizational Behavior and Operations. Total quality management, health administration, finance, marketing, accounting and statistics. Coordinator of Yale/Columbia Graduate School of Business Negotiation Colloquium.

1979 - 1980

Harvard University School of Public Health,
Boston, Massachusetts
Master of Science
Residency in Occupational Medicine

1977 - 1978

National Naval Medical Center,
Bethesda, Maryland
Internal medicine rotating internship
Assistant senior intern.

1976 - 1977

Harvard University School of Public Health,
Boston, Massachusetts
Master of Public Health

1973 - 1977

Cornell University Medical College,
New York, New York
Doctor of Medicine
MD-MPH program.

1970 - 1973

University of Pennsylvania,
Philadelphia, Pennsylvania
Bachelor of Arts magna cum laude
Majors in biology and history.

PUBLICATIONS

Forman, S: "Targeting the Highest-Risk Population to Complement Disease Management" Health Management Technology 49-50, Jul 2004.

Forman SA, Lynch JP: "High Risk Geriatric Population Medical Management" (abstract) J Am Geriatric Assoc S111, May 2001.

Forman SA: "Internet-Deployed Population Based Case Management" Inside Case Management" 7(2), May 2000.

Lynch J, Forman SA, Graff S, Gunby M: "High Risk Population Health Management: Achieving Improved Patient Outcomes and Near-Term Financial Results" Am J Managed Care 6(7):781-791, 2000.

Forman S. "Medicare Risk Plans and Disease Management Vendors" Disease Management and Health Outcomes 7(1):1-4, 2000.

(Book) Forman SA, Kelliher M: *Status One: Breakthroughs in High Risk Population Health Management,* Medical Management Series, Jossey Bass Publishers, San Francisco 1999.

Borron SW, Forman SA, Lockey JE, Lemasters GK, Yee LM: "Dust and Mirrors or Corruption is in the Eye of the Beholder," American Journal of Industrial Medicine 34:409-410, 1998.

Forman SA, Kelliher M, Wood G: "Clinical Improvement with Bottom Line Impact - Custom Care Planning for the Acutely, Chronically Ill in a Managed Care Setting," J Managed Care 3(7): 1039-1048, July 1997.

Borron SW, Forman, SA, Lockey JE, Lemasters GK, Yee LM: "An Unpublished 1932 Study of Asbestosis Among Manufacturing Workers: Reconstruction of the Cohort and Original Findings," American Journal of Industrial Medicine 31: 324-334, 1997.

Ducatman AM, Forman SA, Teichman R, Gleason RE: "Occupational Physician Staffing in Large U.S. Corporations," Journal of Occupational Medicine 33(5): 613-618, 1991.

Forman SA: "A Review of Propylene Glycol Dinitarate Toxicology and Epidemiology," Toxicology Letters 43: 51-65, 1988.

Ducatman AM, Yang WM, Forman SA: "B-Readers and Asbestos Medical Surveillance," Journal of Occupational Medicine 30(8): 644-647, 1988.

Forman SA: "Sublethal Exposure to Microwave Radiation (letter)," Journal of the American Medical Association 259(1): 3129, 1988.

Forman SA: "U.S. Navy Occupational Medicine Through World War Two," Journal of Occupational Medicine 31(1): 28-32, 1988.

Forman SA, Potter HG, Helmkamp JC: "Retrieval Methodology for Inpatient Records," Military Medicine 152: 190-193, 1987.

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Forman SA, Helmkamp JC, Bone CM: "Cardiac Morbidity Associated With Occupational Exposure to 1,2 Propylene Glycol Dinitrate," Journal of Occupational Medicine 25(5): 445-450, 1987.

Forman SA: "Radiation-Induced Breast Cancer (letter)," Archives of Internal Medicine 145: 574-575, 1985.

Helmkamp JC, Forman SA, McNally MS, Bone CM: "Morbidity and Mortality Associated With Exposure to Otto Fuel II in the U.S. Navy 1966-1979," Naval Health Research Center Report 84-35, 1984.

Forman SA: "Industrial Hygiene Records - Will They Be Useful and IBM's Experience With ECHOES," American Conference of Governmental Industrial Hygienists Journal 6: 41,75, 1983.

Forman SA, Holmes CK, McManamon TV, Wedding C: "Psychological Symptoms and Intermittent Hypertension Following Acute Microwave Exposure," Journal of Occupational Medicine 24(11): 932-934, 1982.

Forman SA, Castell DO: "Food Intolerance and Peptic Ulcer Disease," Gastroenterology 75(1): 162, 1978.

ACADEMIC AFFILIATIONS

Organizer of Healthcare 2005, Yale School of Management, Feb 2005.

University of Cincinnati, adjunct associate professor of medicine, 1989 to 2003.

University of Cincinnati, chairman of the post-graduate Medicine Advisory Committee, 1988-1990.

Eastern Virginia Medical College, adjunct assistant professor of family practice and community medicine, 1983-1985.

LICENSES and CERTIFICATIONS

Licensed to practice medicine in Massachusetts, Virginia, California and Ohio.
Board certified in Occupational Medicine.

MEMBERSHIPS

Member, American College of Physician Executives, American Medical Association, and Massachusetts Medical Society
Fellow, American College of Occupational and Environmental Medicine.

INTERESTS

General management within health related businesses. Innovations, strategy and leadership in the cost effective delivery of medical care and the maintenance of high patient functional status.
Enjoy travel, rowing, writing fiction, numismatics, history, and antiques.
Company surgeon of the Lexington Minutemen historical reenactors.

EXHIBIT B

UNCLASSIFIED

151825Z AUG 85 RR UUUU 2271825

ADMIN

NAVENVIRHLTHCEN NORFOLK VA

COMNAVMEDCOM WASHINGTON DC

UNCLAS //N06260//

SUBJ: USE OF NAVAL MEDICAL COMMAND ARCHIVAL MATERIALS

1. PASS TO MEDCOM-00D4 (MR. HERMAN).

2. I HAVE ASSIGNED DR. SAMUEL A. FORMAN THE TASK OF REDISCOVERING HISTORY OF OCCUPATIONAL HEALTH WITHIN NAVY MEDICINE. EFFORT HAS IMPLICATIONS FOR CURRENT CONTINGENCY ROLES AND MORALE OF THE TWIN OCCUPATIONAL MEDICINE AND INDUSTRIAL HYGIENE OFFICER COMMUNITIES. WILL USE OLD BUMED RECORDS AT THE NATIONAL ARCHIVES AND NAVMEDCOM ARCHIVES FROM 20-23 AUG 85.

2. PLEASE ALLOW ACCESS TO APPROPRIATE MATERIALS. AS NATIONAL ARCHIVES MILITARY RECORDS OPEN ONLY DAYTIME HOURS, PLEASE ACCOMODATE WORK AT MEDCOM FROM 1630-2100, IF POSSIBLE.

DR. S. A. FORMAN, OCC MED CONSUL COORDINATOR, 4-4657

326:SAF:HFC
15 AUG 85

CDR J.P. WILKINSON, MSC, USN, 4-4657

MINIMIZE CONSIDERED

Submitted 11/1/85

REQUEST AND AUTHORIZATION FOR TDY TRAVEL OF DOD PERSONNEL

(Reference: Joint Travel Regulations)
Travel Authorized as Indicated in Items 2 through 21.

1. DATE OF REQUEST: 16SEP1985

REQUEST FOR OFFICIAL TRAVEL

2. NAME *(Last, First, Middle Initial)*: FORMAN, SAMUEL A. 177-44-6234	3. POSITION TITLE AND GRADE OR RATING: OCCUPATIONAL MEDICINE CONSULTATION COORD GS-14
4. OFFICIAL STATION: NAVY ENVIRONMENTAL HEALTH CENTER NAVAL STATION, NORFOLK, VA 23511	5. ORGANIZATIONAL ELEMENT: OCCUPATIONAL HEALTH DEPT — 6. PHONE NO.: 444-4657
7. TYPE OF ORDERS: SINGLE — 8. SECURITY CLEARANCE: SECRET CLNC BASED ON NAC COMP 01AUG73 BY DODNACC-DIS	9. PURPOSE OF TDY: HISTORY OF NAVY OCCUPATIONAL HEALTH/ RESEARCH FOR WORKSHOP PRESENTATION (OTHER)
10a. APPROX NO. OF DAYS OF TDY *(Including travel time)*: 3 — b. PROCEED O/A *(Date)*: 18 SEPTEMBER 1985	

11. ITINERARY — [X] VARIATION AUTHORIZED

NATIONAL ARCHIVES BRANCH, SUITLAND, MD AND IN AND AROUND SUITLAND, MD; NATIONAL ARCHIVES, NAVAL HISTORY MUSEUM, WASHINGTON NAVY YARD, NAVMEDCOM, WASHINGTON, DC AND IN AND AROUND WASHINGTON, DC AND RETURN NORFOLK, VA

12. MODE OF TRANSPORTATION

COMMERCIAL: RAIL	AIR	BUS	SHIP	GOVERNMENT: AIR	VEHICLE	SHIP	PRIVATELY OWNED CONVEYANCE *(Check one)*: RATE PER MILE:

[ ] AS DETERMINED BY APPROPRIATE TRANSPORTATION OFFICER *(Overseas Travel only)*

[ ] MORE ADVANTAGEOUS TO GOVERNMENT

[ ] MILEAGE REIMBURSEMENT AND PER DIEM LIMITED TO CONSTRUCTIVE COST OF COMMON CARRIER TRANSPORTATION & RELATED PER DIEM AS DETERMINED IN JTR. TRAVEL TIME LIMITED AS INDICATED IN JTR.

13. [X] PER DIEM AUTHORIZED IN ACCORDANCE WITH JTR.
[ ] OTHER RATE OF PER DIEM *(Specify)*

14. ESTIMATED COST

PER DIEM	TRAVEL	OTHER	TOTAL	15. ADVANCE AUTHORIZED
$ 225.00	$ ---	$ 140.00	$ 365.00	$ ~~283.00~~

16. REMARKS *(Use this space for special requirements, leave, superior or 1st-class accommodations, excess baggage, registration fees, etc.)*

UTILIZATION OF GOVERNMENT FACILITIES NOT REQUIRED AS IT IS CONSIDERED SUCH UTILIZATION WOULD ADVERSELY AFFECT PERFORMANCE OF ASSIGNED TEMPORARY DUTY. LODGING RECEIPTS REQUIRED. RECEIPTS REQUIRED FOR ALL EXPENSES INCURRED OVER $25.00. RENTAL CAR AUTHORIZED. AUTHORIZED MTMC NEGOTIATED COMPACT CAR (A) APPROXIMATELY 600 MILES FOR 3 DAYS. PHONE CALLS FOR OFFICIAL BUSINESS ARE APPROVED FOR PAYMENT.

17. REQUESTING OFFICIAL *(Title and signature)*	18. APPROVING OFFICIAL *(Title and signature)*
	CAPT J. J. BELLANCA, MC, USN, COMMANDING OFFICER

AUTHORIZATION

19. ACCTG. CITATION

APPROPRIATION AND SUBHEAD	OBJECT CLASS	BUREAU CONTROL NUMBER	SUB-AUTH	AUTHORIZATION ACCOUNTING ACTIVITY	TYPE	TRAVEL ORDER *(Tango)* NO.	COST CODE
AA1751804.1800	000	68546	0	66818	2D	50N713	713403383113 (C)

20. ORDER AUTHORIZING OFFICIAL *(Title and signature)* OR AUTHENTICATION	21. DATE ISSUED
CAPT J. J. BELLANCA, MC, USN, COMMANDING OFFICER	16 SEPTEMBER 1985
	22. TRAVEL ORDER NUMBER: N6634068550N0713

DD FORM 1 JUN 67 1610 S/N 0102-LF-016-7702 NAVY OVERPRINT - JAN. 1971

REQUEST AND AUTHORIZATION FOR TDY TRAVEL OF DOD PERSONNEL

(Reference: Joint Travel Regulations)
Travel Authorized as Indicated in Items 2 through 21.

1. DATE OF REQUEST: 15 AUG 85

REQUEST FOR OFFICIAL TRAVEL

2. NAME *(Last, First, Middle Initial)*: FORMAN, SAMUEL A. 177-44-6234	3. POSITION TITLE AND GRADE OR RATING: OCCUPATIONAL MEDICINE CONSULTATION COOR. GS-14
4. OFFICIAL STATION: NAVAL ENVIRONMENTAL HEALTH CENTER, NAVAL STATION, NORFOLK, VIRGINIA 23511	5. ORGANIZATIONAL ELEMENT: OCCUPATIONAL HEALTH DEPARTMENT — 6. PHONE NO.: 444-4657
7. TYPE OF ORDERS: SINGLE — 8. SECURITY CLEARANCE: SECRET CLNC BASED ON NAC COMP 01 AUG 73 BY DODNACC-DIS	9. PURPOSE OF TDY: MISSION
10a. APPROX NO. OF DAYS OF TDY *(Including travel time)*: 4 — b. PROCEED O/A *(Date)*: 20 AUGUST 1985	

11. ITINERARY ☒ VARIATION AUTHORIZED

NATIONAL ARCHIVES, MEDCOM, NAVY HISTORICAL MUSEUM, WASHINGTON, DC, AND IN AND AROUND WASHINGTON, DC AND RETURN NORFOLK.

12. MODE OF TRANSPORTATION

COMMERCIAL				GOVERNMENT			PRIVATELY OWNED CONVEYANCE *(Check one)*
RAIL	AIR	BUS	SHIP	AIR	VEHICLE	SHIP	RATE PER MILE:
							☐ MORE ADVANTAGEOUS TO GOVERNMENT

☐ AS DETERMINED BY APPROPRIATE TRANSPORTATION OFFICER *(Overseas Travel only)*

☐ MILEAGE REIMBURSEMENT AND PER DIEM LIMITED TO CONSTRUCTIVE COST OF COMMON CARRIER TRANSPORTATION & RELATED PER DIEM AS DETERMINED IN JTR. TRAVEL TIME LIMITED AS INDICATED IN JTR.

13. ☒ PER DIEM AUTHORIZED IN ACCORDANCE WITH JTR.
☐ OTHER RATE OF PER DIEM *(Specify)*

14. ESTIMATED COST

PER DIEM	TRAVEL	OTHER	TOTAL	15. ADVANCE AUTHORIZED
$300.00	$78.00	$25.00	$403.00	$ 322.00

16. REMARKS *(Use this space for special requirements, leave, superior or 1st-class accommodations, excess baggage, registration fees, etc.)*

UTILIZATION OF GOVERNMENT FACILITIES NOT REQUIRED AS IT IS CONSIDERED SUCH UTILIZATION WOULD ADVERSELY AFFECT PERFORMANCE OF ASSIGNED TEMPORARY DUTY. LODGING RECEIPTS REQUIRED. RECEIPTS REQUIRED FOR ALL EXPENSES INCURRED OVER $25.00. POC IS AUTHORIZED FOR USE IN AND AROUND TDY STATION ON OFFICIAL BUSINESS. AUTHORIZED TO DEPART FROM AND RETURN TO RESIDENCE IN VIRGINIA BEACH, VA. OWNERS AND OPERATORS STATEMENT: I certify that I am the owner and operator of the private conveyance utilized and primarily responsible for the operating expenses thereof: LICENSE: PA 0934SY

17. REQUESTING OFFICIAL *(Title and signature)*	18. APPROVING OFFICIAL *(Title and signature)*
	CAPT J. J. BELLANCA, MC, USN, COMMANDING OFFICER

AUTHORIZATION

19. ACCTG. CITATION	APPROPRIATION AND SUBHEAD	OBJECT CLASS	BUREAU CONTROL NUMBER	SUB-AUTH	AUTHORIZATION ACCOUNTING ACTIVITY	TYPE	TRAVEL ORDER *(Tango)* NO.	COST CODE
	AA1751804.1830	000	68546	0	66815	2D	50R675	57537718313(2)

20. ORDER AUTHORIZING OFFICIAL *(Title and signature)* OR AUTHENTICATION: CAPT J. J. BELLANCA, MC, USN, COMMANDING OFFICER

21. DATE ISSUED: 15 AUGUST 1985

22. TRAVEL ORDER NUMBER: N6354685500R0675

DD FORM 1 JUN 67 1610 S/N 0102-LF-014-7702 NAVY OVERPRINT - JAN. 1971

REQUEST AND AUTHORIZATION FOR TDY TRAVEL OF DOD PERSONNEL

(Reference: Joint Travel Regulations)
Travel Authorized as Indicated in Items 2 through 21.

1. DATE OF REQUEST: 30 JULY 1985

REQUEST FOR OFFICIAL TRAVEL

2. NAME *(Last, First, Middle Initial)*: FORMAN, SAMUEL A. 177-44-6234
3. POSITION TITLE AND GRADE OR RATING: GS-14 OCCUPATIONAL MEDICINE CONSULTATION COOR.
4. OFFICIAL STATION: NAVY ENVIRONMENTAL HEALTH CENTER NAVAL STATION, NORFOLK, VIRGINIA 23511
5. ORGANIZATIONAL ELEMENT: OCCUPATIONAL HEALTH DEPT.
6. PHONE NO.: 444-4657
7. TYPE OF ORDERS: SINGLE
8. SECURITY CLEARANCE: SECRET CLRC BASED ON NAC COMP 01 AUG 73 BY DODNACC-DIS
9. PURPOSE OF TDY: MISSION (SPECIAL MISSION)
10a. APPROX NO. OF DAYS OF TDY *(Including travel time)*: 5
b. PROCEED O/A *(Date)*: 5 AUGUST 1985
11. ITINERARY — [X] VARIATION AUTHORIZED

HARVARD MEDICAL SCHOOL AND SCHOOL OF PUBLIC HEALTH LIBRARIES, BOSTON, MA AND IN AND AROUND BOSTON, MA AND RETURN NORFOLK, VA

12. MODE OF TRANSPORTATION

COMMERCIAL				GOVERNMENT			PRIVATELY OWNED CONVEYANCE *(Check one)*
RAIL	AIR	BUS	SHIP	AIR	VEHICLE	SHIP	RATE PER MILE:
	X						[ ] MORE ADVANTAGEOUS TO GOVERNMENT

[ ] AS DETERMINED BY APPROPRIATE TRANSPORTATION OFFICER *(Overseas Travel only)*

[ ] MILEAGE REIMBURSEMENT AND PER DIEM LIMITED TO CONSTRUCTIVE COST OF COMMON CARRIER TRANSPORTATION & RELATED PER DIEM AS DETERMINED IN JTR. TRAVEL TIME LIMITED AS INDICATED IN JTR.

13. [X] PER DIEM AUTHORIZED IN ACCORDANCE WITH JTR.
[ ] OTHER RATE OF PER DIEM *(Specify)*

14. ESTIMATED COST

PER DIEM	TRAVEL	OTHER	TOTAL	15. ADVANCE AUTHORIZED
$375.00	$120.00	$50.00	$545.00	$320.00

16. REMARKS *(Use this space for special requirements, leave, superior or 1st-class accommodations, excess baggage, registration fees, etc.)*

UTILIZATION OF GOVERNMENT FACILITIES NOT REQUIRED AS IT IS CONSIDERED SUCH UTILIZATION WOULD ADVERSELY AFFECT PERFORMANCE OF ASSIGNED TEMPORARY DUTY. LODGING RECEIPTS REQUIRED. RECEIPTS REQUIRED FOR ALL EXPENSES INCURRED OVER $25.00. COMMERCIAL AIR IS AUTHORIZED. AUTHORITY TO USE TAXI/LIMO SERVICE. LIBRARY USER AND COPIER FEE AUTHORIZED. PHONE CALLS FOR OFFICIAL BUSINESS ARE APPROVED FOR PAYMENT.

17. REQUESTING OFFICIAL *(Title and signature)*

18. APPROVING OFFICIAL *(Title and signature)*: CAPT J. J. BELLANCA, MSU, USN, COMMANDING OFFICER

AUTHORIZATION

19. ACCTG. CITATION

APPROPRIATION AND SUBHEAD	OBJECT CLASS	BUREAU CONTROL NUMBER	SUB-AUTH	AUTHORIZATION ACCOUNTING ACTIVITY	TYPE	TRAVEL ORDER (Tango) NO.	COST CODE
AA1751804.1880	000	68546	0	66918	20	6BN603	6033555N3113(E)

20. ORDER AUTHORIZING OFFICIAL *(Title and signature)* OR AUTHENTICATION: CAPT J. J. BELLANCA, MC, USN, COMMANDING OFFICER

21. DATE ISSUED: 30 JULY 1985
22. TRAVEL ORDER NUMBER: 6686466855ON0603

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EXHIBIT C

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US Navy Shipyard Occupational Medicine through World War II

Samuel A. Forman, MD, MPH

For more than 60 years the US Navy has maintained occupational health programs for its civil service workers in shipyards, arsenals, and aircraft repair facilities. The early history of the organization, people, and professional activities dedicated to the health of this large federal industrial workforce is examined.

Early efforts were stimulated by increasingly complex naval technology and worker compensation law. During World War II training, clinical, and preventive programs were pursued vigorously. Navy occupational health paralleled and at times led the development of occupational medicine and industrial hygiene in America.

The history of United States Navy occupational medicine encompasses health aspects of one of the largest federal industries during peace and war. It is a history paralleling, and at times leading, the development of occupation health in this country. This paper utilizes mostly primary sources to trace the origins of Navy occupational medicine through 1945, ending with the Second World War demobilization. The latter period marked a pause in professional progress and later activities are both within living memory and have been discussed elsewhere.[1]

In the late 19th century new seagoing technologies multiplied naval health hazards. Introduction of iron warships made naval construction and repair a diverse, heavy industry (Fig. 1). An array of occupational activities that were essentially unknown in the days of wooden ships and sail propulsion characterized work supporting the new fleets. In addition to the age-old injury problems of falls from scaffolding and rigging, there were hazards incident to riveting, welding, painting with rust-inhibiting lead paints, chipping, sandblasting, metal casting, ordnance loading, and electric wiring.

Several occupational health problems were recognized by 1900, but little preventive action was taken. For example, deafness among boilermakers and gunners mates was an accepted fact of life.[2] Toxic conditions gained attention only if they afflicted many people and compromised a ship crew's readiness for duty.[3] Greater preventive medical interest was shown in the prevalent and pressing problems of sailors such as infectious diseases and minimally adequate shipboard ventilation.[4,5]

The health of civil service workmen in many shipyards and arsenals received little attention. Injuries might be treated in the station military dispensary,[6] at the discretion of the commanding officer. There was no provision for disability benefits if a prolonged health problem occurred.

Worker compensation laws enacted in the first 2 decades of the 20th century placed financial responsibility for occupational injuries on the employer. The first comprehensive compensation plan for federal employees became law in 1916. Unlike state plans, which were most often administered by insurance companies, benefits for Navy civil service workers were administered directly by the government through its Employees Compensation Commission. The aggregate bill for benefits was served to the Secretary of the Navy each year. Financial losses resulting from civil service employee worker compensation were deducted from the Navy budget. As dollar losses became a highly visible and painful reminder of occupational health issues, occupational health, previously an obscure topic, gained a measure of recognition.

The First World War witnessed a large increase of industrial activities in shipyards and supporting shore stations. More Navy physicians recognized that occu-

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The views presented are those of the author and do not represent the official position of the Department of the Navy or the Naval Medical Command.

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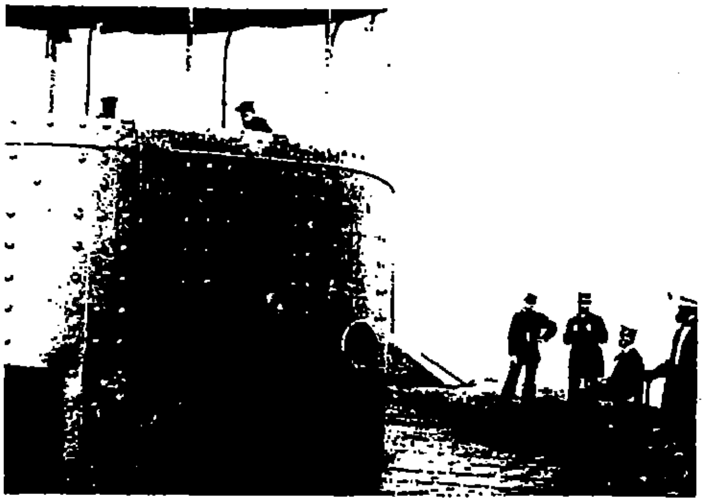

Fig. 1. Introduction of iron warships made naval construction and repair a diverse, heavy industry. The crew of USS Monitor observes its riveted iron turret and rifled steel cannon following the battle with CSS Virginia in 1862. (Courtesy of US Navy Imaging Command, Washington, DC)

pational health services, then consisting mostly of injury care and employment physical examinations, helped keep the work force on the job.[7,8] Although a few locations developed rudimentary occupational clinics, such interest remained the exception.

Poor compensation experience, as measured by both dollars and lost-time injuries, attracted critical comment from the Federal worker compensation program, whose administrator requested inspections of several Navy shipyards in 1917.[9] Detection and correction of toxic industrial hazards initially received a secondary priority to control of numerous and evident safety hazards.[10] Even so, Navy workers were maimed by exposed belt drives long after these dangerous mechanisms were safely enclosed in most private industrial establishments.

As WW I progressed, ineffective occupational health programs came to be recognized as impairing the war effort through needless waste of industrial manpower. Although plans for better services within both the Navy and the private sector took shape in mid-1918,[11,12] the end of the war halted their implementation. Navy government industries were rapidly demobilized to peacetime levels.

One legacy of the war years remained to sustain and advance the nucleus of a full-time Navy occupational medicine function. Criticism by the Employee Compensation Commission and the Secretary of the Navy for poor compensation cost experience led to ongoing programs in both safety and industrial hygiene. In 1917, a safety engineer was appointed and others were later assigned to each shipyard. In 1929, full-time medical officers were assigned to assist each safety officer in occupational health matters.[13] At the Navy Bureau of Medicine and Surgery, occupational medicine responsibilities were added to its preventive medicine division. From the beginning, organized occupational health was focused on the civil servants laboring in Navy shipyards.

An early initiative came from Dr Robert Jones at the Navy Bureau of Medicine and Surgery, who recommended periodic physical examinations for a variety of occupations based on their potential toxic exposures. Of interest, screening of asbestos workers for pulmonary diseases was recommended along with examinations for more widely recognized conditions such as silicosis and lead poisoning.[14] Unfortunately, resources to provide such services were most often not obtainable from each base's commanding officer.

Nevertheless, a new vigor and purpose came to occupational health programs. Some performed excellent services for the Navy and workers at their locations. Boston Naval Shipyard Clinic sent one of its doctors in 1933 to complete postgraduate occupational medicine studies at the Harvard School of Public Health.[15] In 1935, Dr Ernest Brown completed a survey of lead poisoning in Philadelphia Naval Shipyard welders. He exhibited a disciplined and wide-ranging approach including clinical assessment, evaluation of work practices, and environmental sampling. Not content with passively describing the workplace, he devised hazard control strategies including altered work practices and adaptations of respiratory protection equipment.[16]

Other bases lagged in their occupational health and safety efforts. In some instances the occupational physician might retreat into the clinic to be exclusively occupied with acute injury treatment. Military base safety officers were often untrained and ineffective.[17]

There was a growing appreciation for the importance of job-specific pre-employment physical examinations.[18] Unlike active duty sailors who had to pass an induction "pre-employment" examination before donning the uniform, civilian employees were examined only when required by the base commanding officer and under general guidelines of the Civil Service Commission. Pre-

employment examinations comprised a significant enterpise for the 1920s work force numbering almost 60,000

Uniformed Navy personnel continued to receive variable occupational medical services. Almost from their introduction into the service, hazards inherent in aircraft and submarine environments gained the attention of dedicated medical professionals. When other occupational conditions were addressed at all, it was often in the context of a health problem severe enough to immediately impair health and fitness for duty. Examples include sailors' noise-induced hearing loss,[19,20] lead encephalopathy,[21] nitroglycerin poisoning,[22] and painting solvent intoxication.[23] These endeavors remained distinct from organized Navy occupational medicine, which remained oriented toward civil service worker health.

By the end of the 1930s, a small, full-time group of occupational health physicians had been in place for a number of years.[24] A few physicians, like Dr Ernest Brown, achieved superior competence in the practice of occupational medicine. Although all programs had not been uniformly successful, and adequate resources were hard to come by, the organization was poised to meet requirements arising from an anticipated industrial mobilization.[25]

As war clouds gathered, Rear Admiral Charles Stephenson (Fig. 2), in charge of preventive medicine at the Navy Bureau of Medicine and Surgery, faced the challenge of building upon the modest Navy occupational health program of the previous decades. The general approach to maritime industries was already being discussed. Navy yards, arsenals, and air stations would gear up to produce and maintain specific, often complex ships and weapons, yet remain flexible enough to accommodate anticipated battle repairs. Using an organizational model revived from WW I, the US Maritime Commission would give contracts to private companies to mass-produce vessels such as "Liberty" transport ships and landing assault craft.

Immediate challenges included defining the scope of Navy occupational health, obtaining the backing of the military hierarchy, and staffing the effort with trained individuals. A coherent blueprint for the content of military occupational health was provided by Dr Ernest Brown. He envisioned services to include clinical care for injuries, job placement medical certifications, surveillance examinations for noxious work exposures, and workplace hazard inspections and controls.[26,27]

The next challenge was providing skilled manpower at a time when large industries monopolized the few qualified people.[28] The most viable answer was a timely proposal from Philip Drinker at the Harvard School of Public Health for training military officers in short courses of instruction.[29] Professor Drinker was already a well-known authority who had invented the "iron lung" mechanical respirator in 1929,[30] devised means to quantify and control industrial dust exposures,[31] and pioneered concepts in permissible exposure limits. Stephenson sent two bright Navy physicians, Drs Otto Burton and Howard Karl Sessions, to complete the occupational medicine master's degree program at Harvard during 1941.

Concurrently, Stephenson worked to empower the organization to tackle expanded responsibilities without external interference. An unsolicited attempt by the Public Health Service to perform occupational health inspections of naval facilities was promptly declined,[32,33] reportedly with the support of President Roosevelt.[34] For industrial activities all occupational health services would be provided from within the Navy.

The new Navy program was adopted and announced with some fanfare[35] (Fig. 3). It included pre-employment examinations,[36] injury care, medical surveillance for known occupational health hazards, and industrial hygiene field surveys. Shipyards developed well-staffed occupational health services manned by professionals in uniform and comprising both clinical and industrial hygiene divisions. These were located at the largest industrial facility in each of the 12 naval districts and lent occupational health support to smaller naval facilities in their areas.[37]

Key manpower was to be provided by training uniformed officers in short courses as proposed by Philip Drinker. By the war's close some 111 naval officers had completed the courses, most classes having convened at Harvard[38] and a few at Columbia[39] Schools of Public Health. Of interest, 29 officers, unlike their classmates, were non-physicians, a group comprising one of the first formal training programs in modern industrial hygiene. Both physicians and hygienists shared formal lectures but separated during laboratory periods. Doctors attended industrial clinics and hygienists learned sampling strategies, laboratory assays, and hazard-control techniques. An additional 16 hygienists were taken on active duty, having already gained experience in industrial settings.

The role of occupational health within the US Mari-

Fig. 2. Rear Admiral Charles S. Stephenson (1887–1965) was instrumental in designing and implementing the Navy occupational medicine program during WW II. (Courtesy of the Naval Medical Command, Washington, DC)

Fig. 3. As illustrated by contemporary poster art, injury care, physical examination, and protective measures were aspects of the Navy wartime occupational medicine program. (Courtesy of the National Archives, Washington, DC)

time Commission evolved in 1942. Philip Drinker was also active here.[40] As chief medical consultant he was instrumental in the adoption of joint Navy - Maritime Commission health and safety standards for contract shipyards.[41] The health guidelines were based largely on the experience of a traveling health team's findings in the course of inspections of representative shipyards. In August 1942, the team was professionally staffed with loaned Navy physicians and industrial hygienists.

Contract shipyards that the Maritime Commission supervised provided their own injury treatment measures, whereas industrial hygiene inspection services were provided by government personnel. Qualified people were unavailable to institute the inspection services, so arrangements were made with the Navy to provide uniformed men. They were assigned to four regional offices: one physician and two industrial hygienists each to Philadelphia and Oakland and one industrial hygienist each to the offices in New Orleans and Chicago.[42]

In contrast to the program of the Maritime Commission, the Navy occupational health program had no traveling consultants or inspectors. When occupational health issues of general importance to naval industries arose or when special expertise beyond that in each naval district was required, Drinker's team was consulted. Health questions related to welding[43,44] and asbestos insulation work were the subjects of health hazard evaluations by the Maritime Commission during the war.

Asbestos workplace field investigations have had long-term significance. There had been anecdotal case reports implicating asbestos in lung disease from naval shipyard clinics.[45–47] A Maritime Commission field survey at a civilian contract shipyard revealed two laggers with x-ray evidence of asbestosis among a small number of tradesmen.[48] Navy occupational health officers were concerned enough about such findings that they cooperated with Philip Drinker in his proposal to do a large-scale pulmonary survey of asbestos insulation workers and obtained permission to extend the survey to two naval shipyards.[49]

Only three asbestosis cases were identified among more than 1,000 asbestos insulation workers who participated in the chest x-ray screenings at four shipyards.[50,51] Disease prevalence appeared low, an artifact caused by the inadvertent dilution of the at-risk population with briefly exposed persons. Low asbestosis prevalence in shipyard workers was interpreted in the professional community to mean that asbestos lagging operations were relatively free of pneumoconiosis risk.[52] Although these early studies concerning asbestos hazards did not stand the test of time,[53,54] they represented superior occupational health methods of their era.

Industrial health activities were rapidly demobilized by 1946. The Maritime Commission health consultation office was disbanded. Although few physicians and industrial hygienists remained in active Navy service, those who gained experience during the war, like Drs. Otto Burton and Howard Karl Sessions and industrial hygienists Sidney Goren and George Johnson, led Navy programs through the 1950s.

Navy occupational health had played an important role in wartime industries. Its organization included superior practitioners. It broke new ground for industrial hygiene as a distinct health-related profession. It confidently tackled known health issues and actively pursued newer ones. Members of this team, veterans of occupational medicine and industrial hygiene services in Navy shipyards, arsenals, air stations, and the Maritime Commission, shared a common experience. Taking their know-how with them into private industry, government, and academia, Navy programs left a distinctive mark on American occupational health for many years.

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EXHIBIT D

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UNITED STATES NAVAL

MEDICAL BULLETIN

PUBLISHED FOR THE

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BUREAU OF MEDICINE AND SURGERY

NAVY DEPARTMENT

NOVEMBER 1927

WASHINGTON

GOVERNMENT PRINTING OFFICE

Vol. XVII.
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THE DIVISION OF PREVENTIVE MEDICINE.

Lieut. Commander R. F. Jones, Medical Corps, United States Navy, in charge.

Notes on Preventive Medicine for Medical Officers, United States Navy.

INSTRUCTIONS TO MEDICAL OFFICERS.

OCCUPATION HAZARDS AND DIAGNOSTIC SIGNS: A GUIDE TO IMPAIRMENTS TO BE LOOKED FOR IN HAZARDOUS OCCUPATIONS.

By Louis I. Dublin, Ph. D., Statistician Metropolitan Life Insurance Co., and Philip Leiboff.

INTRODUCTION.

Many occupations have injurious effects on the physical condition of those engaged in them. The health of those who work with the poisons, such as lead, arsenic, mercury, picric acid, etc., or those who are exposed for long periods to dust, heat, humidity, or to the infectious materials, etc., may be impaired seriously as the result of their work. The occupation is now recognized as of the very first importance as a factor in the causation of disability and even of death. Doctor Edsall has shown that in his clinic at the Massachusetts General Hospital many of the conditions for which treatment is sought by men of working ages are the effects of occupations.[1] Other industrial clinics are reporting similar results. With their attention directed to occupation as a possible factor, industrial physicians are able to diagnose a great many obscure cases which previously had puzzled even the most competent clinicians. In this way they discover a great many more cases of disease of occupational origin than had before been thought possible. Thus, in 1917 about 150 cases of lead poisoning were discovered at the Massachusetts General Hospital, which are more than were recorded by this clinic during the five-year period prior to the adoption of the more intensive methods of study. It is generally recognized that patients come to physicians with pains and complaints of an indefinite char-

[1] See Monthly Labor Review of the U. S. Bureau of Labor Statistics, December, 1917, p. 169–186.

acter, and it is only when consideration is given to the occupation and its possible effects that many of these cases are cleared up.

The medical examiner should, therefore, be very careful to see if any of the usual diagnostic signs of poisoning, dust, heat, or other hazards which are known to be inherent in occupations are in evidence among their patients where no other explanation of the case is readily available. In the case of those exposed to lead, such as employees of storage-battery plants, white-lead workers, paint mixers, painters, etc., the blue line on the gum, the pale, sallow appearance, and the trembling fingers are significant as indications of chronic lead poisoning, and the physician should look for these signs. Physical symptoms and conditions which ordinarily might be passed by in this way become very important if they point to the possible effect of the occupation.

This article has been prepared to aid physicians in general practice, industrial hygienists, safety engineers, and others who come into close professional contact with those who are engaged in industrial processes. Nine major hazards of employment are listed, namely, abnormalities of temperature; compressed air; dampness; dust; extreme light; infections; poor illumination; repeated motion, pressure, or shock; and the poisons. A separate section is devoted to a discussion of skin irritants. Long exposure to any of these will usually leave definite physical signs which the medical examiner can discover if he will look for them. To aid him in detecting the hazards and their effects on the worker, two lists are presented. The first consists of the more common hazardous occupations, arranged alphabetically; the second consists of hazards, together with their effects or symptoms, as well as the occupations affected. After each occupation in the first list is a reference in code to the particular hazard in the second list. The capital letters after each occupation, "A," "B," "C," etc., refer to the general hazard. The Arabic numerals signify the particular hazard, as "D1," inorganic dust; "D2," organic dust.

The following example will show how this guide may be of value to the general practitioner: A man, who works in a garage, suffering from continuous headaches, visits his physician. The latter can find no cause for the patient's illness. The patient shows no signs of disease other than the subjective symptoms which he describes. Perhaps the physician will recommend an examination of the subject's eyes, ears, and sinuses, which will prove negative. A puzzling diagnosis such as this becomes very simple when the occupation is ascertained and this guide is utilized. Alongside of "Garage workers" in the "Alphabetical list of hazardous occupations," the physician finds the symbols J 16, 25. "J" represents the hazard poisons and "16, 25" the particular poisons—carbon monoxide and gasoline,

No. 5.

respectively; the second; in small q; removal of; The foll; examiner; cant. He; hazardous; person has; of some h; particular; make speci; the second; the person; pation. I; Physicians; detect the; pation as; not fit the; Medical; keep in mi; as well. P; engaged in; condition.; sometimes; which are; medical pro; forming the; nosing and

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Acetylene ma; Acid dippers,; Acid finishers; Acid makers,; Acid mixers, J; Acid recoverer; Acid transport; Airplane-wing; also Varnis; Alcohol distil; Aldehyde pas; Alkali salt ma; 47.; Amber worker; Ammonium ma; 22, 26, 48.

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respectively. Upon looking up the symptoms of these poisons in the second list he finds that both produce headache when inhaled in small quantities. In such a case the effective remedy lies in the removal of the etiological factor—the two poisons.

The following procedure is therefore recommended: The medical examiner or physician should ascertain the occupation of the applicant. He should then look for it in the "Alphabetical list of hazardous occupations." If found there, it is possible that the person has been exposed to and is possibly suffering from the effects of some hazard of the occupation. The numerals will indicate the particular hazards of the occupation. The physician should then make special effort to discover the symptoms or signs referred to in the second list. By this means he can readily determine whether the person examined is in fact suffering from the effect of his occupation. His examination is in this way made more illuminating. Physicians, not specialists in occupational hygiene, can thus learn to detect the effects of industry and, conversely, can eliminate the occupation as the cause when certain symptoms are observed which do not fit the usually observed effects of the occupation.

Medical examiners should remember that it is often necessary to keep in mind not only the present occupation but the former one as well. Persons suffering from certain ailments may no longer be engaged in the industry which was originally responsible for their condition. But careful inquiry into their occupational history will sometimes result in the recording of an occupation the effects of which are clearly those from which the patient is suffering. The medical profession must give occupational findings greater weight in forming their judgments regarding physical conditions and in diagnosing and treating disease.

ALPHABETICAL LIST OF HAZARDOUS OCCUPATIONS.

Acetylene makers, D 1, J 4, 16, 48.
Acid dippers, C, J 10, 22, 26, 37, 48.
Acid finishers (glass), J 26, 28, 48.
Acid makers. *See* particular acid.
Acid mixers, J 26, 37, 48.
Acid recoverers, J 26, 37, 48.
Acid transporters, J 26, 37, 48.
Airplane-wing varnishers, J 50. *See also* Varnishers.
Alcohol distillery workers, J 5, 8.
Aldehyde pumpers, J 1, 50.
Alkali salt makers, C, J 14, 18, 26, 46, 47.
Amber workers, J 28.
Ammonium salts makers, A 1, J 4, 15, 22, 26, 48.
Ammonium sulphate makers, J 48.
Aniline dye makers. *See* Dye makers.
Aniline makers, J 7, 10, 12, 26, 34, 37.
Animal hair dressers. *See* Hair workers.
Animal handlers, F 1, 3.
Annealers, A 2.
Antimony extractors (refiners), A 1, J 3.
Antimony fluoride extractors, J 27.
Antipyrin makers, J 31, 40.
Arsenic roasters, A 1, J 9.
Art-glass workers, J 5, 11, 27, 28, 30, 52.
Artificial flower makers, H, J 9, 21, 23, 29, 30.

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1, F 2, G, H, J 14,
2, G, J 1, 23, 20.
J 20.
1, J 7, 8, 9,
rs (miscellaneous),
dry). D 1.
h molders, Floor
8.
0, 11, 12, 21, 37.
makers. See Cel-
J 9, 30.
ine operators, E.
rs, See Hydro-
s. See Acid mix-
makers, J 23.
See also Electro-
J 23, 37, 48.
J 10, 23, 35, 37,
e Linoleum mak-
orkers, J 33, 40.
roleum refiners.
13.
ent workers (iron
E.
rers, A 2, G.
12, 23, 28, 30, 52.
7, 11, 12, 15, 23,
J 23.
le), A 1.
I.
9, 21, 23.

LIST OF HAZARDS, SYMPTOMS, OCCUPATIONS EXPOSED, AND PREVENTION.

A. Abnormalities of Temperature.

The primary physiological effect of abnormal temperatures is the disturbance of the heat-regulating system of the body. Heat dilates the blood vessels on the surface of the body, increasing the supply of blood in this region. Cold, on the other hand, constricts the blood vessels, causing a diminished blood supply on the body surface. Continuous abrupt changes from one extreme of temperature to another may cause serious congestion of the internal organs, the heat-regulating system of the body not being capable of adapting itself to sudden variations. It is in this way that a cold draft, which causes a sudden variation of the temperature, may produce neuralgia, paralysis, and respiratory diseases. Extremes of temperature may produce pathological changes by direct action. Thus, extreme dry heat will cause conjunctivitis, cataract, and the familiar sunburn. Extreme cold may cause frostbite and eczema. With the above data in mind, abnormalities of temperature have been classified under only two headings, namely, "Sudden variations of temperature" and "Extreme dry heat." Extreme cold has not been listed as a distinct hazard, because a temperature so low as to cause the direct effects mentioned above is rarely met in industry. It is evident that the occupations listed in the division "Extreme dry heat" are exposed not only to the danger of the direct action of the high temperatures but also to the hazard "Sudden variations of temperature."

The prevention of disease due to exposure to extremes of temperature consists, obviously, in the avoidance of sudden variations of temperature. Drafts are particularly hazardous, and may be practically eliminated by the use of vestibule and storm doors. Workers in cold processes should keep active and avoid chill. The hot-process worker should allow his body to cool off gradually after completion of the day's work. He should carefully regulate his diet, drinking plenty of water and avoiding meats. As direct preventive measures for the effects of extreme heat, it is advisable to make use of shields, helmets, goggles, water-cooled furnace doors, exhaust systems, cold air, fans, etc.

No. 5.

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A. Abnormalities of Temperatures.

Health hazard.	Symptoms, conditions, or diseases to look for.	Occupations which offer such exposure.
1. Extreme dry heat.	Anemia, general debility, catarrh, stiff joints, cramps, lumbago, Bright's disease, skin eruptions, premature old age, cataracts, retinitis, conjunctivitis.	Ammonium salts makers; annealers; antimony extracters (refiners); arsenic roasters; bar-mill workers (iron and steel); bessemer-converter workers (iron and steel); beta-still operators (beta naphthol); billet-mill workers (iron and steel); bisque-kiln workers; blacksmiths; blast-furnace workers; blooming-mill workers (iron and steel); blowers-out (zinc smelting); blowers (revolvers); boiler-room workers; brass founders; braziers; brick burners; brick makers; burners (enameling); cappers (window glass); carbide makers; carborundum makers; case hardeners; casters (iron and steel); catchers (iron and steel); cement workers; chargers (smelting); chargers (zinc smelting); coke-oven workers; color makers; copper smelters; core makers; cremators (glass industry); cridlemen (iron and steel); crucible-steel-department employees; cupola men (foundries); cyanamid makers; drawers (glass); drop forgers; enamelers; fettlers (glass); floor molders (foundry); forgemen; foundry workers; furnace workers; gatherers (glass); glass blowers; glass-furnace workers; graphite workers; hardeners (metals); hot-rod rollers (iron and steel); iron and steel workers (all departments); junk (metal) refiners; kiln tenders; layer pushers (glass); leadball makers; lead smelters; leer tenders (glass); leversmen (iron and steel); lifters-over (glass); lixiviators (zinc smelting); markers (glass); melters (foundry; glass); mercury smelters; muffle tenders; open-hearth-department workers (iron and steel); pair heaters (tin plate); paraffin petroleum refiners; pit molders (foundry); pot fillers (glass); potlifters (iron and steel); pot pullers (foundry); pot-room workers (aluminum foundry; carbide plant); pot setters; pottery workers; pourers (foundry); puddlers (iron and steel); pyrites burners; refiners (metals); rollers (metals); roll setters (iron and steel); roll wrenchers (iron and steel); roughers (iron and steel); shove-in boys (glass); skimmers (glass); slag-machine tenders (iron and steel); still (coal-tar) cleaners; stillmen (carbolic acid); stillmen operating; stokers; sulphur burners; table operators (iron and steel); takers-down (glass); tappers (smelting); teasers (glass); temperers; tin-foil makers; tinners; tongsmen (iron and steel); topmen (foundry); tube makers (glass); turners-out (glass); welders; zinc smelters.
2. Sudden variations of temperature.	Congestion of internal organs, catarrh, neuralgic and rheumatic affections, gastro-intestinal and vesical catarrh, pneumonia, Bright's disease.	Artificial-ice makers; bakers; bleachers; brewers; butchers; caisson workers; calenderers (rubber); calico printers; candy makers; canners; cartridge shot shell paraffin dippers; charcoal workers (sugar refining); clay and marble [illegible] (pottery); cold-storage-plant workers; cooks; digester-house workers (paper and pulp); drum tenders (textile); drivers; dry cleaners; dryers (felt hats); drying-room workers (miscellaneous); dye makers; dyers; electrotypers; evaporator operators (soap); fat renderers; felt-hat makers; fishermen; flangers (felt hats); gas (illuminating) workers; glost-kiln workers; glue workers; hothouse workers; ice cream makers; ironers; japan makers; lasters (shoes); laundry workers; linoleum makers; lumbermen; miners; mirror silverers; mixers (rubber); motormen; packing-house employees; paper makers; patent-leather makers; phosphate-mill workers; phosphorus-evaporating machine operators; press-room workers (rubber); refrigerating-plant workers; roofers; rubber workers; sailors; salt preparers; shoe finishers; silver melters; soap makers; spreaders (rubber works); stearic-acid makers; stereotypers; straw-hat makers; sugar refiners; sulphite cooks (pulp mill); table turners (enameling); textile workers; thread glazers; tile makers; varnish makers; vulcanizers; wall paper printers; warehouse employees (generally); wool scourers. *See also* occupations exposed to extreme dry heat.

B. Compressed Air.

In building tunnels, laying deep foundations for large buildings, etc., it is necessary for the work to be carried on under increased air pressure in order to prevent the entrance of water into the excavations. The laborer is lowered gradually and at short intervals the

pressure of the air in the compartment is increased. The first sensation of compression is felt on the eardrums, which may be relieved by the act of swallowing. If the air is too quickly compressed hemorrhage may occur. The greater part of the danger of working in compressed air lies in hasty decompression. While under compression the blood and tissue juices dissolve an increased amount of air, the gases of which are released when the pressure is suddenly decreased. The bubbles thus formed cut off the blood supply from various parts of the body by blocking up the capillaries. The symptoms of compressed air illness, the so-called "bends," are the result.

Workers in compressed air must follow strictly the rules governing gradual compression and decompression, especially the latter. It is not advisable for boys and for men over 40 years of age to work under high pressure.

B. Compressed air.

Health hazard.	Symptom, condition, or disease to look for.	Occupations which offer such exposure.
Compressed air......	Weakness, vertigo, pains in the back and legs, paralysis of legs and arms, painful constriction of the chest, cerebral hemorrhage and aphasia, coma, subcutaneous hemorrhages, impairment of hearing.	Caisson workers; divers; tunnel workers.

C. DAMPNESS.

The moisture content of the air is very important for the proper adjustment of the physiologic processes of the body. Damp air will prevent the evaporation of moisture from the body and will therefore affect the body temperature. High humidity tends to increase the effects of high temperature. Moist cold air has the effect of undermining the general vitality of the organism, weakening its resistance to diseases of the respiratory passages, and to neuralgic and rheumatic affections. The same effects are noticed among workers around open tanks and vats, who are continuously working in wet clothes. Excessive dampness suggests dry air as a hazard. The latter causes chapped skin and catarrhal conditions. It has not been listed among the hazards because it is not characteristic of any one occupation but is prevalent generally, especially during the winter months.

When dampness is a feature of an industrial process the following precautions should be taken to avoid ill effects:

(1) Provision of exhaust systems wherever steam is generated.

(2) Provision of floors with drain channels to prevent the accumulation of water.

(3) Provision of adequate waterproof clothing, such as rubber boots, rubberized aprons, etc.

Wherever there is dampness special measures should be taken to keep the humidity at its proper percentage. In this connection the wet-bulb thermometer is invaluable in determining the degree of moisture in the air. By circulating the air the effects of high humidity may be mitigated.

C. Dampness.

Health hazard.	Symptom, condition, or disease to look for.	Occupations which offer such exposure.
Dampness	Diseases of the respiratory passages, neuralgia and rheumatic affections.	Acid dippers; alkali-salt makers; artificial-ice makers; artificial-silk makers; auto painters; bakers (tannery); basement workers (tanners); beatermen (paper and pulp); bleachers; bleachery dryers; blockers (felt hats); boiler washers; brewers; brickmakers; cable splicers; caisson workers; calico printers; candy makers; canners; cartridge-cap washers; cartridge felt and wad makers; cartridge shell parafin dippers; charcoal workers (sugar refining); clay and biscuit makers (pottery); clay-plug makers (pottery); cloth preparers; concentrating-mill workers (lead and zinc); cotton-mill workers; creosoting-plant workers; digester-house workers (paper and pulp); doffers (textile); drawer tenders (textile); drivers; dye makers; dyers; electroplaters; enamelers; explosive workers; extractor operators (soap); felt calenderers; felt-hat makers; fertilizer makers; filter-press workers; fishermen; flax spinners; flesh tenders ([illegible]); galvanizers; glass cutters; glass finishers; glost dippers (pottery); glove makers (leather preparers); glue workers; grinders (metals); guncotton washers; hat workers; ice-cream makers; leather (shoes); laundry workers; lime pullers (tannery); linoleum makers; masons; match-factory workers; millers; mirror silverers; nickel platers; packing-house employees; paint makers; paper makers; petroleum refiners; phosphate-mill workers; phosphorus-evaporating-machine operators; plaiters; plasterers; pottery workers; preparers (tannery); pressmen (oil refining); pullers-out (felt hats); pulp-mill employees; refrigerating-plant workers; roller scourers (cotton mills); sagger makers; salt preparers; screen tenders (pulp mill); sewer workers; shavers (felt hats, fur, tannery); sizers (felt hats); slip makers (pottery); smoothers (glass); soap makers; soda makers; sodium-hydroxide makers; spongers; stamp-mill workers; starters (felt hats); stone cutters (wet process); sugar refiners; sulphite cooks (pulp mill); tanners (tannery); table hands (tannery); [illegible] tannery workers; telephone linemen (trench work); temperers; textile workers; thread [illegible]; tile makers; tinners; tobacco moisteners; turpentine extractors; vulcanizers; velvet makers; vulcanizers (shoes); wall-paper printers; washers; washers (rubber); wool sorters.

D. Dust.

Dusts have here been divided into two kinds, according to their chemical composition, namely, organic and inorganic. The difference in symptoms listed under each is based on the findings of recent investigators that organic dusts do not cause pulmonary lesions. Dr. H. R. M. Landis [*] has found that wherever fibrosis was present in the lungs of men exposed to organic dust, the latter was always mixed with some form of mineral or metallic dust. Tobacco workers exposed to organic dust for years showed no pulmonary changes other than those found in people living in the city. Mineral and metallic dusts, however, produce fibrosis of the lung tissue, the

[*] See article on "The Pathological and Clinical Manifestations Following the Inhalation of Dust," in The Journal of Industrial Hygiene, July, 1919, pp. 117–129.

extent of which depends on the time of exposure and the particular dust inhaled. Of the inorganic dusts, silica is the most harmful, producing serious pulmonary damage in a comparatively short period of time, while the least harmful are those which produce slight changes and then only after long exposure, for example, lime, coal, etc. The relationship between occupational dust and tuberculosis is rather a doubtful one. Authorities disagree as to the effect of fibrosis on the resisting power to the tubercle bacillus. Dust, by acting as a carrier of the bacilli, may increase their number in the lungs. In this way, men exposed to dust may be in greater danger of contracting turberculosis than others. Dr. H. R. M. Landis claims, however, that in the trades exposed to inorganic dust, mistaken diagnosis of pneumoconiosis swells the mortality statistics for tuberculosis. As a means of avoiding incorrect diagnosis of pneumoconiosis, Roentgen ray examinations of the lungs and sputum analyses are invaluable.

There are four effective methods that may be used to prevent the inhalation of dust generated during industrial processes. No one of these can apply to all conditions, but the particular method to be used must be adapted to the peculiarities of the process.

(1) The use of water to dampen the dust and thus prevent it from rising and filling the atmosphere.

(2) The use of exhaust systems which remove the dust at the point of origin.

(3) The use of inclosing chambers in which the dust-producing processes are confined, being regulated from the outside.

(4) The use of respirators and helmets.

In many cases it may be necessary to combine several of these measures effectively to prevent the inhalation of dust by the worker.

D. Dust.

Health hazard.	Symptom, condition, or disease to look for.	Occupations which offer such exposure.
1. Inorganic dust....	Cough, dyspnea, pleuritic pains, hemoptysis, clubbed fingers, marked flatness of chest, deficient expansion (unilateral), dullness, diminished resonance, sonorous rales, fibrosis, inflammatory condition of eyes, ears, nose, and throat; orbits, chronic catarrh of respiratory tract, chronic catarrh of digestive tract, pleurisy, tuberculosis.	Acetylene makers; asbestos workers; basic slag (artificial manure) workers; battery (dry) makers; bed rubbers (marble and stone); bench molders (foundry); bevelers; blast-furnace workers; bone workers; brickmakers; bronzers; building wreckers; burrers (needles); burr dressers; button makers; calenderers (rubber); carbide makers; carbon-brush makers; carborundum workers; card grinders (textiles); casting cleaners (foundry); cement workers; charcoal workers (sugar refining); chargers (smelting); chargers (zinc smelting); chasers (steel); chimney sweepers; chippers; clay and bisque makers (pottery); clay-plug makers (pottery); color makers; compounders (rubber); [illegible] workers (dust and slag); core makers; crucible makers; crushermen (clay and stone); cut-glass workers; cutlery makers; cyanamid makers; diamond cutters; electrotypers; emery-wheel makers; engravers; fertilizer workers; file cutters; flint workers; floor molders (foundry); flue cleaners; foundry workers; glass blowers; glass cutters; glass finishers; glass mixers; glaze mixers (pottery); gold beaters; gold refiners; graphite workers; grinders (metals); gypsum workers; horn workers; jewelers; junk (metal)

D. Dust—Continued.

Health hazard.	Symptoms, condition, or disease to look for.	Occupations which offer such exposure.
1. Inorganic dust—Continued.	Cough, dyspnea, pleuritic pains, etc.—Continued.	refiners; lapidaries; lead smelters; lime burners; lime-kiln chargers; lime workers; linoleum makers; lithographers; marble cutters; masons; match-factory workers; metal turners; mica strippers or splitters; mica workers; millers; mixers (rubber); mixing-room workers (miscellaneous); mold breakers (foundry); paint removers; paperhangers; phosphate-mill workers; pit molders (foundry); planer men (stone, metal); plasterers; plaster of Paris workers; pneumatic-tool workers; polishers; pottery workers; pouncers (felt hats); pressmen (printers); printers; putty makers; putty polishers (glass); pyrites burners; quarrymen; rubber workers; sagger makers; salt preparers; sand blasters; sand cutters; sanders; sanding machine operators; sandpaperers (enameling and painting auto bodies, etc.); saw filers; screeners (foundry); screen workers (lead and zinc smelting); sifters; sintering-plant workers; slate workers; slip makers (pottery); smoothers (glass); spinners (asbestos); stamp-mill workers; statuary workers; stonecutters (dry); stonecutters (wet process); sugar refiners; sulphur burners; table turners (enameling); [illegible] makers; tile makers; tool makers; top fillers (foundry); tumbling-barrel workers; weighers.
2. Organic dust.....	Dryness of nose, throat, and mouth, cough, anaphylaxis, asthma, bronchitis, emphysema, tuberculosis.	Bakers; beamers (textiles); blowers (felt hats); broom makers; brushers (felt hats); brush makers; buffers; button makers; carbonizers (shoddy); carders (textiles); card grinders (textiles); carpet makers; celluloid polishers; celluloid workers; cigar makers; cobblers; comb makers (celluloid); coners (felt hats); cork workers; cotton-mill workers; cotton twisters; curriers (tannery); devil operators (felt hats); doffers (textiles); feather curlers; feather workers; felt-hat makers; fiber workers; finishers (leather); flax spinners; flour workers; formers (felt hats); fur carders; fur clippers; fur cutters; fur handlers; fur preparers; fur pullers; glove makers (leather preparers); glue workers; grain-elevator workers; grinders (rubber); guncotton pickers; hair workers; harness makers; heel makers (shoe); hemp workers; jute workers; knitting-mill workers; lace makers; lasters (shoes); leather workers; linen workers; match-factory workers; mattress makers; mixers (felt hats); mixing-room workers (miscellaneous); pouncers (felt hats); rag workers; roller coverers (cotton mills); ropemakers; rubber workers; sawmill workers; scourers, wood heels (shoes); shavers (felt hats, furs, tannery); shaving-brush makers; shoddy workers; shoe-factory operatives; sifters; silk workers; softeners (tannery); spinners (textiles); starch makers; straw-hat makers; taxidermists; textile workers; tobacco rollers; tobacco workers; upholsterers; weavers; weighers; wood-heel scourers (shoes); wood workers; wool carders; wool spinners; wool workers.

E. EXTREME LIGHT.

Intense light is usually a product of a process associated with heat. Among the different kinds of light included under this heading are the arc light, furnace glare, glowing metal or glass, and X ray. Poor illumination as a hazard is treated under "G. Poor illumination." Continuous exposure to strong light is not only irritating to the conjunctiva, but may also cause a degeneration of the retina and decomposition of the visual purple. Repeated electric flashes of brilliant light have caused severe ophthalmia, retinitis, and even blindness. Glass blowers and steel puddlers, who have to look at a glowing molten mass, are apt to develop cataracts. It seems that the invisible ultra-violet rays and infra-red rays are responsible. The introduction of X rays into the medical field has brought to light the highly

dangerous character of the radiographer's work. Severe dermatitis and cancer may ensue after exposure to X rays.

The following protective devices prove effective in preventing the injurious action of extreme light:

(1) Shields.
(2) Helmets.
(3) Goggles which eliminate the ultra-violet and infra-red rays.
(4) Clothing which covers the skin completely.
(5) X-ray apparatus should be inclosed as completely as possible with lead plates.

E. Extreme light.

Health hazard.	Symptoms, condition, or disease to look for.	Occupations which offer such exposure.
Extreme light......	Cataracts, retinitis, conjunctivitis, dermatitis, ulceration and [illegible] of the skin, electrical ophthalmia, cancer.	Blacksmiths; electricians; electric linemen; furnace-workers; glass blowers; glass-furnace workers; incandescent-mantle hardeners; moving-picture machine operators; oxyacetylene cutters; photographers; puddlers (iron and steel); stokers; welding; X-ray workers.

F. INFECTIONS.

There are many infectious diseases, such as tetanus, trachoma, and syphilis, which are often of occupational origin. They are not, however, specifically occupational; that is, they do not arise from a condition caused by an industrial process. The conditions which cause these diseases in industry are identical with those which cause them out of industry. The above-mentioned diseases have not therefore been included in this list of occupational infections. Those diseases which have been included arise primarily in occupational exposure. There are a number of other diseases which occur in occupations, but these are of such little numerical importance that they also have not been included.

Besides the general rules of sanitation, the following measures are recommended:

(1) *Anthrax.*—All hides and animal hair must be thoroughly sterilized. Foreign skins or hair should not be carried on the unprotected shoulder. The hands should be frequently washed with bichloride of mercury. Hair sorters should wear respirators.

(2) *Hookworm.*—Workers in mines and others who are exposed to infected soil should make special effort to keep the skin clean. Shoes must always be worn and gloves are also of value in preventing the entrance of the hookworm through the skin. Infected soil should be disinfected and kept dry. The stools of infected individuals must be disinfected immediately.

(3) *Septic infections.*—Workers should avoid puncturing the skin. Cuts, scratches, or abrasions should be treated at once to avoid in-

fection. Men having open wounds should not be allowed to work with putrid material.

F. Infections.

Health hazard.	Symptoms, condition, or disease to look for.	Occupations which offer such exposure.
1. Anthrax: External	1. *Malignant pustule.*—Begins as an usual pimple or boil. Papule becomes hard, with a purple center and deep red base after [illegible] surrounding, appearance of minute vesicular areola. Central papule becomes vesicular, discharges thick, bloody serum, later forming a brown gangrene. A painful lymphangitis with hard edema extending over neck and arm. Local phlebitis in the edematous area, chilliness, anorexia, vomiting, prostration, high temperature; feeble pulse. 2. *Malignant edema.*—A spreading inflammation of loose connective tissue accompanied by sloughing and gangrene. Constitutional symptoms those of pyemia.	Animal handlers; beaters (tannery); beam house workers (tannery); brush makers; butchers; carpet makers; cattle salesmen; [illegible]; farmers; fertilizer makers; fur carders; fur clippers; fur cutters; fur handlers; fur preparers; fur pullers; hair workers; leather workers; lime pullers (tannery); longshoremen; meat inspectors; preparers (tannery); shavers (felt hats, fur tannery); shaving brush makers; sheepherders; stablemen; [illegible] (tannery); table hands (tannery); tannery workers in [illegible]; transporters of hides and wool; veterinarians; wool carders; wool spinners; wool workers.
Internal	High fever, pains in head and back, vomiting, constipation, pain and tenderness in the abdomen, rapid, feeble pulse, palpable spleen, dyspnea, cyanosis. May be hemorrhages from bowels. When lungs are involved, there are additional symptoms—cough, pain in the chest, [illegible].	
2. Hookworm (ankylostomiasis).	Anemia, pallor of the face even when the blood count is not very low; a dull, heavy, listless expression, memory, speech, and still increasing muscular weakness; occurrence of [illegible] in stool. Victims often complain of gastrointestinal pains and cramps; in exaggerated cases there are edema, ascites, progressive emaciation, protuberant abdomen, and increasing stupor.	Brick makers; construction campworkers; farmers; lumbermen; miners (quarrymen); sawmill workers; trench diggers; tunnel workers; workers who come in contact with infected soil, especially prevalent in gold mines of California.
3. Septic infections.	Skin infections such as boils, carbuncles, blood poisoning, localized lymphangitis or cellulitis.	Animal handlers; butchers; canners; feather workers; fertilizer makers; garbage workers; glue makers; hair workers; preparers (tannery); rag workers; shavers (felt hats, fur, tannery); shoddy makers; silk workers; soap makers; tallow refiners; tannery workers; veterinarians; handlers of putrid or decomposing animal products.

G. Poor Illumination.

The effects of poor illumination are not easily apparent. The hazard may be present in any plant, but is especially prevalent in a limited number of occupations because of the peculiar conditions that make it difficult properly to illuminate the workroom. Miner's nystagmus is the outstanding example of the effects of this hazard. Poor illumination is not only the cause of the conditions listed below but is also an important factor in the causation of accidents.

Artificial light is least harmful to the worker when it comes from overhead, reflected from the ceiling by inverted bowl-shaped reflectors. Light-colored walls and ceilings aid materially in properly illuminating a room. Special precaution must be taken to avoid glare. All lights should be shaded so that only diffused light reaches the eye.

G. Poor illumination.

Health hazard.	Symptom, condition, or disease to look for.	Occupations which offer such exposure.
Poor illumination...	Nystagmus, eyestrain, deficient vision due to [illegible] or hyperopia, headache, giddiness. Eyestrain contributes to neurasthenia.	Buffers; burnishers (brass and steel); [illegible] workers; compositors; embroidery workers; jewelers; metal polishers; miners; photographers; steel engravers; tunnel workers; watchmakers; any factory worker.

II. REPEATED MOTION, PRESSURE, SHOCK, ETC.

Under this heading are included those muscle-strain conditions which are caused by the continuous repetition of movements, pressure, or blows. This section is not concerned with the neurasthenic phenomena which are sometimes called occupational neurosis. Everyone is familiar with the muscular strain experienced in performing for the first time some exercise, such as rowing, long walking, etc. Men newly introduced into a process requiring such repeated action are affected similarly but often much more severely, so as to disable them temporarily for the particular job. The injury does not stop with muscular strain but may even cause inflammation of the surrounding sheaths or paralysis of the parts concerned.

Many types of occupational neurosis may be avoided by working at a comfortable pace, avoiding fatigue. Where continuous pressure or shock is the cause, pads or cushions are often beneficial. Workers who have to grasp tools tightly would do well frequently to change their method of holding the instrument, if this is possible. Occasional rest periods will do much toward the prevention of muscular pains and cramps.

H. Repeated motion, pressure, shock, etc.

Health hazard.	Symptoms, condition, or disease to look for.	Occupations which offer such exposure.
Repeated motion, pressure, shock, etc.	Pain of muscle used, set up by a myositis, bursitis, synovitis, or other local changes of a chronic inflammatory nature, trembling, gradual emaciation and partial paralysis of parts, neuropathies.	Artificial-flower makers; barbers; bicyclists; [illegible] carpenters; chauffeurs; clerks; [illegible] compositors; [illegible] drivers; [illegible] engravers; gold beaters; hammermen; [illegible] lithographers; locksmiths; [illegible] painters; paper-box makers; [illegible] pneumatic-tool workers; porters; [illegible] riveters; sailors; sawyers; [illegible] sewing-machine operators; spinners (textile); stone cutters (dry); stone cutters (wet process); tailors; telegraphers; typists; washerwomen; watchmakers; weavers.

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* See United Stat

ful to the worker when it comes from ceiling by inverted bowl-shaped re- ...eilings aid materially in properly ...ecaution must be taken to avoid ...led so that only diffused light reaches

... r illumination.

...poses	Occupations which offer such exposure.
[illegible]	[illegible] ... tory workers.

...y, Pressure, Shock, Etc.

...luded those muscle-strain conditions ...nuous repetition of movements, pres- ...not concerned with the neurasthenic ...times called occupational neurosis. ...muscular strain experienced in per- ...exercise, such as rowing, long walk- ...ed into a process requiring such re- ...ilarly but often much more severely, ...ly for the particular job. The injury ...train but may even cause inflamma- ...s or paralysis of the parts concerned. ...neurosis may be avoided by working ...fatigue. Where continuous pressure ...ushions are often beneficial. Workers ...v would do well frequently to change ...nstrument, if this is possible. Occa- ...h toward the prevention of muscular

...ion, pressure, shock, etc.

Occupations which offer such exposure.
Artificial-flower makers; barbers; [illegible] ... washerwomen; watchmakers; weavers.

J. Poisons.

The continued introduction of new processes making use of new poisonous substances in industry makes this section of more and more importance. The enormous increase in the production of dye-stuffs and other chemicals will no doubt show its effects on the workmen in the form of industrial poisoning. During the war the increased production of trinitrotoluol and tetrachlorethane for air-plane dope resulted in a large number of cases of poisoning from these substances. For the data presented under this heading, the revised "List of industrial poisons," compiled by Sommerfeld and Fischer for the International Association for Labor Legislation, has been drawn upon largely. The arrangement is similar.[2] The material in that list has been revised and brought up to date. Several poisons have been added and all the occupations exposed are given for each poison. The symptoms are those given by recent investigators. In order to avoid swelling the list of poisons to unwarranted proportions, substances the effects of which are similar have been grouped. Thus all nitro compounds of benzol and its homologues have been included under one heading and the same procedure has been followed with amido compounds. An endeavor has been made to limit this list to those substances the actions of which are mainly constitutional. The next section (p. 912) is devoted to the substances occurring in industry which act as skin irritants. Because of the very large number of substances in the latter class, it has not been possible to treat them as fully as the other poisons.

To prevent industrial poisoning the following precautions should be taken: Personal cleanliness must be maintained. Workers must be instructed as to the toxicity of the substances handled. Frequent medical examinations of workers must be made to detect early symptoms of disease. Men should not be allowed to eat in workrooms where poisonous substances are handled. Work clothes should be removed at end of day's work. Proper lavatory facilities should be provided. Work clothes should receive special attention. The use of gloves and boots are often necessary. Mechanical devices for confining the poisons are of prime importance. (See also preventive measures, under "Dust.") Fumes and gases should be taken care of by proper ventilation, the use of exhaust systems, fans, and blowers. Men who work in an atmosphere polluted by poisonous fumes and gases should always wear gas masks properly suited for the obtaining conditions.

[2] See United States Bureau of Labor, Bulletin No. 100, May, 1912.

J. Poisons.

Health hazard.	Symptoms, condition, or disease to look for.	Occupations which offer such exposure.
1. Acetaldehyde....	Irritation of the mucous membranes of the nose, larynx, bronchi, and eyes; acceleration of the heart's action; profuse night sweats.	Aldehyde pump men; celluloid makers; dye makers; explosives workers; mirror silverers, varnish makers; vinegar workers.
2. Acridine........	Irritation and inflammation of skin and mucous membranes, severe burning and itching of the skin, violent sneezing.	Dye makers.
3. Acrolein........	Itching in the throat, irritation of the eyes, exciting lachrymation, conjunctivitis, irritation of the air passages, bronchial catarrh.	Bone renderers; fat renderers; galvanizers; feed makers; linoleum makers; linseed oil boilers; soap makers; stearic-acid makers; tallow refiners; tinners; varnish boilers.
4. Ammonia........	Acute inflammation of the respiratory organs, cough, edema of the lungs, chronic bronchial catarrh, redness of the eyes, increased secretion of saliva, retention of the urine.	Acetylene makers; ammonium-salt makers; artificial-ice makers; artificial-silk makers; boneblack makers; bronzers; coke-oven workers; dye makers; dyers; galvanizers; gas (illuminating) workers; gas purifiers; glue workers; lacquerers; refrigerating-plant workers; salt extractors (coke-oven by-products); sewer workers; shellac makers; shoe finishers; soda makers; sugar refiners; tanners; varnish makers.
5. Amyl acetate....	Nervous symptoms, headache, heaviness of the head, giddiness, numbness, nausea, disturbances of digestion, palpitation of the heart, inflammation of the respiratory organs, fatty degeneration of the liver.	Alcohol-distillery workers; art-glass workers; artificial-silk makers; battery (dry) makers; bronze [illegible]; celluloid makers; cutlery makers; enamelers; explosives workers; furniture polishers; gilders; incandescent-lamp makers; jewelers; lacquer makers; [illegible] (leather); patent-leather makers; photographic-film makers; shoe factory workers; shoe finishers; smokeless-powder makers; toy makers; wirers (incandescent lamps).
6. Amyl alcohol....	Congestion of the head, oppression of the chest, irritation of the air passages, lowering of the blood pressure, faintness, nausea.	Alcohol-distillery workers; dye makers; fruit-essence makers; mordanters; shoe finishers.
7. Aniline and other amino compounds of benzol and its homologues.	Pallor of the skin, vertigo, unsteady gait, loss of appetite, increased frequency of respiration, nausea, slowing of the pulse, eczematous eruptions, bloody urine, spasmodic muscular pains, cyanosis.	Aniline makers; artificial-leather makers; calico printers; coal-tar workers; compositors; compounders (rubber); dye makers; explosives workers; feather workers; lithographers; millinery workers; mixers (rubber); painters; paint makers; pencil (colored) makers; photographic workers; pressroom workers (rubber); [illegible] (rubber); rubber workers; tannery workers; vulcanizers.
8. Antimony and its compounds.	Itching eruptions of the skin; inflammation of the mouth, throat, and stomach; albumin in the urine, weakness of the heart, vertigo, faintness, coryza, dyspepsia, intestinal colic, nephritis.	Antimony extractors (refiners); brass founders; burnishers (iron and steel); burnishers (rifle barrels); calico printers; color makers; compositors; compounders (rubber); dye makers; enamel makers; fireworks makers; glass makers; glaze dippers (pottery); glaze mixers (pottery); grinders (metals); grinders (rubber); lead smelters; linotypers; mixers (rubber); monotypers; mordanters; pressroom workers (rubber); printers; rubber workers; shot makers; stereotypers; vulcanizers.
9. Arsenic and its compounds.	Headache, melancholia, [illegible] symptoms, gastrointestinal disturbances, emaciation, catarrh of the mucous membranes, skin diseases of various forms, falling out of the hair and nails, melanosis, perforations of the nasal	Arsenic roasters; artificial-flower makers; artificial-leather makers; bookbinders; brass founders; bronzers; calico printers; candle (colored) makers; carpet makers; carroters (felt hats); chemists [illegible]; color makers; colored-paper workers; compounders (rubber); copper founders; copper smelters; curriers (tannery); cut-glass workers; decorators (pottery); dye makers; electroplaters; enamelers; leather curriers; feather workers; felt-hat makers; fireworks workers; fur handlers; fur preparers; galvanizers; gardeners; glass mixers; glaze dippers (pottery); glaze mixers (pottery); gold refiners;

J. Poi

Health hazard.	Symptoms, condition, or disease to look for.
9. Arsenic and its compounds—Continued.	septum, bleeding gums, peripheral multiple neuritis, paralysis.
10. Arseniureted hydrogen.	General malaise, difficulty of breathing, fainting fits, gastric disturbance, jaundice, bluish discoloration of the mucous membrane, pain in the region of the spleen and kidney, darkened urine, odor of the mouth resembling garlic.
11. Benzine........	Headache, vertigo, nausea, cough, irregular respiration, weakness of the heart, drowsiness, cyanosis, twitching of the muscles, psychosis, skin lesions.
12. Benzol.........	Headache, vertigo, anemia, muscular tremor, scarlet lips, spots of extravasated blood in the skin, irritant cough, fatty degeneration of liver, kidneys, and heart.
13. Brass (zinc).....	Headache, general malaise, throat irritation, cough, nausea, vomiting, constipation, trembling, muscular pains, accelerated respiration, profuse sweating, deposit of green tartar on the teeth, metallic taste in the mouth, anemia, premature old age, respiratory and degenerative diseases.
14. Carbon dioxide..	Anemia, cyanosis, headache, drowsiness, vertigo, tinnitus, and general nervousness.

...upations which offer such exposure.

...; celluloid makers; dye makers; ...; mirror silverers; varnish makers; ...

[illegible]

J. Poisons—Continued.

Health hazard.	Symptom, condition, or disease to look for.	Occupations which offer such exposure.
9. Arsenic and its compounds—Continued.	septum, bleeding gums, peripheral multiple neuritis, paralysis.	Insecticide makers; japan makers; jewelers; lead smelters; linoleum coloring; lithographers; mixers (rubber); mordanters; paper glazers; paperhangers; pencil (colored) makers; pitch workers; pottery workers; pressroom workers (rubber); printers; pottery burners; refiners (metals); rubber-tire builders; rubber washers; rubber workers; sealing-wax makers; sheep-dip makers; shot makers; sprayers (trees); sulphur burners; sulphuric-acid workers; tannery workers; taxidermists; tinners; toy makers; velvet makers; wallpaper printers; wax ornament makers; wire drawers; wood preservers; zinc makers.
10. Arseniuretted hydrogen.	General malaise, difficulty of breathing, fainting fits, gastric disturbance, jaundice, bluish discoloration of the mucous membrane, pain in the region of the spleen and kidney, darkened urine, odor of the mouth resembling garlic.	Acid dippers; aniline workers; balloon (toy) fillers; battery (dry) makers; bronzers; carbonizers (shoddy); dimethyl-sulphate makers; dye makers; enamelers; ferro-silicon workers; fertilizer makers; galvanizers; lead burners; [illegible] makers; [illegible] lead temperers; lime burners; pyrogallic makers; picklers; refiners (metals); shoddy workers; submarine (storage battery) workers; sulphuric acid workers; tinners; tinsmiths (sulphuric acid); zinc chloride makers.
11. Benzine	Headache, vertigo, nausea, cough, irregular respiration, weakness of the heart, drowsiness, cyanosis, twitching of the muscles, pneumonia, skin lesions.	Art-glass workers; bronzers; buffers (rubber); cast scrubbers (electroplaters); celluloid makers; cementers (rubber shoes); cement mixers (rubber); compositors; compounders (rubber); curriers (tannery); decorators (pottery); degreasers (fertilizer, leather); dippers (rubber); dry cleaners; electroplaters; enamelers; feather workers; furniture polishers; gilders; glue workers; japan makers; lacquer makers; linoleum makers; lithographers; millinery workers; mixers (rubber); mordanters; painters; paint makers; pressroom workers (rubber); printers; putty makers; rubber-glove makers; rubber-tire builders; rubber washers; rubber workers; shellac makers; shoe finishers; tannery workers; type cleaners; varnish makers; vulcanizers.
12. Benzol	Headache, vertigo, anemia, muscular tremor, scarlet lips, spots of extravasated blood in the skin, irritant cough, fatty degeneration of liver, kidneys, and heart.	Aniline makers; artificial-leather makers; battery (dry) makers; benzol distillers; bronzers; carbolic-acid makers; cast scrubbers; cementers (rubber shoes); cement mixers (rubber); coal-tar workers; coke-oven workers; color makers; compounders (rubber); decorators (pottery); degreasers (fertilizer, leather); dry cleaners; driers (rubber); dye makers; electroplaters; explosives workers; feather workers; fertilizer makers; gas (illuminating) workers; gilders; glue workers; lacquer makers; lithographers; millinery workers; mixers (rubber); mordanters; painters; paint makers; photo-engravers; photographic workers; pressroom workers (rubber); reclaimers (rubber); rubber-tire builders; rubber washers; rubber workers; shellac makers; shoe-factory workers; shoe finishers; smokeless-powder makers; still (coal-tar) cleaners; treaders (rubber); varnish makers; vulcanizers.
13. Brass (zinc)	Headache, general malaise, throat irritation, cough, nausea, vomiting, constipation, trembling, muscular pains, accelerated respiration, profuse sweating, deposit of green tartar on the teeth, metallic taste in the mouth, anemia, premature old age, respiratory and degenerative diseases.	Bench molders (foundry); blowers-out (zinc smelting); brass founders; braziers; bronzers; chargers (zinc smelting); core makers; floor molders (foundry); galvanizers; junk-metal refiners; kilners (zinc smelting); pourers (brass foundry); welders; zinc smelters.
14. Carbon dioxide	Anemia, cyanosis, headache, drowsiness, vertigo, dyspnea, and general nervousness.	Alkali-salt makers; blacksmiths; boiler-room workers; brass founders; brewers; brick burners; caisson workers; carbon-dioxide makers; charcoal burners; drying-room workers (miscellaneous); fertilizer makers; furnace workers; lime burners; limekiln chargers; miners; pottery workers; sewer workers; silo workers; soda makers; starch makers; sugar refiners; vintners; white-lead makers; yeast makers.

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J. Poisons—Continued.

Health hazard.	Symptoms, condition, or disease to look for.	Occupations which offer such exposure.
15. Carbon disulphide.	Headache, pain in the extremities, trembling, dizziness, reduction of the reflexes, acceleration of the heart's action, nausea, digestive trouble, emaciation, disturbances of sense of vision, excitement and violent temper followed by depression, hyperexcitation of sexual instinct, later its abnormal decline, chronic dementia.	Ammonium-salts makers; artificial-silk makers; asphalt testers; carbon-disulphide makers; celluloid makers; cementers (rubber); [illegible] cement makers (rubber); dry cleaners; driers (rubber); enamelers; glue workers; [illegible] makers; match-factory workers; oil extract[illegible]; paint makers; paraffin workers; putty makers; rubber (rubber); smokeless-powder makers; sulphur extract[illegible]; tallow refiners; Vulcanizers.
16. Carbon monoxide.	Headache (usually frontal), dizziness, sense of fullness of the head, tinnitus, nausea, general weakness, polycythemia.	Acetylene makers; bakers; blast-furnace workers; blacksmiths; blasters; [illegible] boiler-room workers; brass founders; cable splicers; calico printers; carbide makers; celluloid makers; charcoal burners; chargers (zinc smelting); chimney sweepers; coal-tar workers; coke-oven workers; copper smelters; core makers; drying-room workers (miscellaneous); enamelers; [illegible] makers; filament makers (incandescent lamps); finishers (incandescent lamps); [illegible] laundry workers; furnace workers; garage workers; gas (illuminating) workers; glass-kiln workers; incandescent-lamp makers; kiln tenders; laundry workers; lead smelters; lime burners; linoleum chargers; mercury smelters; miners; patent-leather makers; phosgene makers; pottery workers; pressers; [illegible] makers; [illegible] sealers (incandescent lamps); silver melters; singers (cloth); soda makers; [illegible] (steel); temperers; tubulators (incandescent lamps); zinc smelters.
17. Chloride of lime.	Irritating cough, inflammation of upper air passages, difficulty of breathing, bronchitis, asthma, sometimes hemoptysis, conjunctivitis, lachrymation, hyperhidrosis, burning eruption on the skin.	Bleachers; chloride of lime makers; chloroform makers; disinfectant makers; dye makers; laundry workers; tannery workers.
18. Chlorine	Pallid countenance, emaciation, decayed teeth, bronchial irritation and asthma, gastric disturbances, irritation of the skin, chloracne.	Alkali-salt makers; beatermen (paper and pulp); bleachers; bromine makers; calico printers; chloride of lime makers; chlorine makers; disinfectant makers; dye makers; laundry workers; phosgene makers; photographic workers; sulphur-chloride makers; zinc-chloride makers.
19. Chlorodinitrobenzol.	See Nitrobenzol.	
20. Chloronitrobenzol.	See Nitrobenzol.	
21. Chromium compounds.	Pitting, phagedenic ulcers, very difficult to heal and very painful; perforation of the nasal septum at the cartilaginous portion, irritation of the conjunctiva, small areas of inflammation in the lungs, inflammation of the kidneys, chronic gastritis, anemia.	Artificial-flower makers; battery (dry) makers; bleachers; calico printers; candle (colored) makers; chromium workers; color makers; compounders (rubber); dye makers; dyers; enamelers; glass makers; glaze dippers (pottery); glaze mixers (pottery); ink makers; linoleum colorers; lithographers; match-factory workers; mixers (rubber); mordanters; paperhangers; pencil (colored) makers; photo-engravers; photographic workers; processors (rubber); rubber-tire builders; rubber washers; rubber workers; tannery workers; vulcanizers; wall-paper printers; wax-ornament workers; wood stainers.
22. Cyanogen compounds.	Headache, vertigo, unsteadiness of gait, nausea, loss of appetite, disturbance of gastric and intestinal functions, slowing of the pulse, albuminuria.	Acid dippers; ammonium-salts makers; blacksmiths; blast-furnace workers; bronzers (gun barrels); calico printers; case hardeners; celluloid makers; dye makers; electroplaters; fulminate mixers; furriers; gas (illuminating) workers; gas purifiers; gold refiners; photographic workers; picklers; silver refiners; tannery workers, temperers.

J. Poisons—Co[illegible]

Health hazard.	Symptoms, condition, or disease to look for.	C[illegible]
23. Dimethyl sulphate.	Strongly corrosive effect on the skin and mucous membranes, hoarseness, lachrymation, conjunctivitis, edema, photophobia.	Dimethyl-[illegible]
24. Dinitrobenzol.	See Nitrobenzol.	
25. Gasoline.	See Naphtha.	
26. Hydrochloric acid.	Irritation of mucous membranes; conjunctivitis, coryza, pharyngeal, laryngeal, and bronchial catarrh; dental caries.	Acid dipp[illegible] ers; ca[illegible] alkali ma[illegible] calico p[illegible] carbonic[illegible] dyers; g[illegible] glass be[illegible] acid ma[illegible] tory wo[illegible] shoddy [illegible] ners; Vi[illegible]
27. Hydrofluoric acid.	Intense irritation of the eyelids and conjunctiva, coryza, bronchial catarrh with spasmodic cough, ulceration of the nostrils, gums, and oral mucous membranes; painful ulcers of the cuticle, erosion and formation of vesicles, suppuration under the finger nails.	Antimony[illegible] dyers; et[illegible] ers; etc[illegible]
28. Lead and its compounds.	Sallow, pale, yellowish hue of the skin; metallic taste, nausea, anemia, constipation, lead line, asthenia, insomnia, headache, arthralgias and neuritis, weakness of grip, tremors of fingers and tongue; lead paralyses, especially of muscles used most; atrophy of optic nerve.	Acid [illegible] artificial[illegible] ers; bea[illegible] (tannery[illegible] ers; brass[illegible] bronzers[illegible] (rubber)[illegible] split ers[illegible] lain ma[illegible] ers (w[illegible] varnish[illegible] ers; com[illegible] ers; dye[illegible] workers[illegible] ters; fil[illegible] finishers[illegible] (pottery)[illegible] [illegible] fuel of [illegible] dry [illegible] jewelers[illegible] quer ma[illegible] lead-plat[illegible] [illegible] ers; litho[illegible] [illegible] instrume[illegible] [illegible] ers; [illegible] photogra[illegible] pottery [illegible] ers (rubb[illegible] ers (ma[illegible] [illegible] sheet-me[illegible] [illegible] ers (sol[illegible] age-batte[illegible] ers (ena[illegible] ers; tin-[illegible] ers (pot[illegible] wallpape[illegible] stainers[illegible]

[illegible]—Continued.

Occupations which offer such exposure.
[illegible] tallow refiners; vulcanizers.
[illegible] workers.
Alkali-salt makers; [illegible] sulphur-chloride makers; zinc-chloride makers.
Artificial-flower makers; battery (dry) makers; [illegible] printers; wax-[illegible] workers; wood stainers.
Acid dippers; ammonium-salts makers; blacksmiths; [illegible] gas purifiers; gold refiners; photographic workers; picklers; silver refiners; tannery workers; temperers.

J. Poisons—Continued.

Health hazard.	Symptoms, condition, of disease to look for.	Occupations which offer such exposure.
23. Dimethyl sulphate.	Strongly corrosive effect on the skin and mucous membranes, hoarseness, lachrymation, conjunctivitis, edema, photophobia.	Dimethyl-sulphate makers; dye makers; perfume makers.
24. Dinitrobenzol.	See Nitrobenzol.	
25. Gasoline.	See Naphtha.	
26. Hydrochloric acid.	Irritation of mucous membranes; conjunctivitis, coryza, pharyngeal, laryngeal, and bronchial catarrh; dental caries.	Acid dippers; acid finishers (glass); acid mixers; acid recoverers; acid transporters; alkali-salt makers; ammonium-salts makers; aniline makers; battery (dry) makers; calico printers; camphor makers; carbolic-acid makers; carbonizers (shoddy); cartridge dippers; dye makers; dyers; enamel makers; fertilizer makers; galvanizers; glass finishers; glass mixers; glue workers; hydrochloric-acid makers; jewelers; petroleum refiners; picklers; pottery workers; reclaimers (rubber); rubber workers; shoddy workers; solderers; sulphur-chloride makers; tinners; vignetters; zinc-chloride makers.
27. Hydrofluoric acid.	Intense irritation of the eyelids and conjunctiva, coryza, bronchial catarrh with pneumonia, coughing, ulceration of the nostrils, gums, and oral mucous membranes; painful ulcers of the skin, erosion and formation of vesicles, suppuration under the finger nails.	Antimony fluoride extractors; art-glass workers; bleachers; dyers; etchers; fertilizer makers; glass finishers; silicate extractors.
28. Lead and its compounds.	Sallow, pale, yellowish hue of the skin; metallic taste, nausea, anaemia, constipation, lead line, anorexia, insomnia, headache, arthralgias and neuritis, a sensation of grip, tremors of fingers and tongue; lead paralysis, especially of muscles used most; atrophy of optic nerve.	Acid finishers (glass); amber workers; art-glass workers; artificial-flower makers; babbitters; battery (dry) makers; bench makers (foundry); [illegible] (tannery); [illegible]; bottle-cap makers; brass founders; brass polishers; braziers; brick burners; brick makers; bronzers; brewers (gun barrels); brush makers; buffers (rubber); burners (enameling); cable makers; cable splicers; calico printers; canners; cartridge makers; celluloid makers; chargers (zinc smelting); cigar makers; colorers (white) of shoes; compositors; [illegible] workers (lead and zinc); cut-glass workers; cutlery makers; decorators (pottery); diamond polishers; dye makers; dyers; electroplaters; electrotypers; [illegible] workers; emery-wheel makers; enamel makers; file cutters; filers; floor makers (foundry); galvanizers; glass finishers; glass makers; glass polishers; glaze dippers (pottery); glaze mixers (pottery); glost-kiln workers; gold refiners; grinders (metals); grinders (rubber); [illegible] (printers); imitation-pearl makers; incandescent-lamp makers; [illegible] makers; [illegible] makers; jewelers; junk-metal refiners; [illegible]; lacquer makers; lead burners; lead-foil makers; lead miners; lead-pipe makers; lead-cake makers; lead smelters; linoleum makers; linotypers; linseed-oil boilers; lithographers; lithotransfer workers; match-factory workers; [illegible] (rubber); monotypers; musical-instrument makers; nitric-acid workers; nitroglycerin makers; painters; paint makers; paint removers; paperhangers; patent-leather makers; petroleum refiners; photograph retouchers; pipe fitters; plumbers; polishers; pottery workers; printers; putty makers; putty polishers (glass); reclaimers (rubber); red-lead workers; refiners (metals); riveters; roofers; rubber workers; sagger makers; sandpaperers (enameling and painting auto bodies, etc.); screen workers (lead and zinc smelting); sheet-metal workers; shellac makers; shot makers; slip makers (pottery); slushers (porcelain enameling); solderers; stainers (shoes); steel engravers; stereotypers; storage-battery makers; sulphuric-acid workers; [illegible] (enameling); tannery workers; temperers; tile makers; tin-foil makers; tinners; toy makers; transfer workers (pottery); tree sprayers; type founders; typesetters; wallpaper printers; welders; white-lead workers; wood stainers; zinc smelters.

J. Poisons—Continued.

Health hazard.	Symptoms, condition, or disease to look for.	Occupations which offer such exposure.
29. Mercury and its compounds.	Ptyalism, swelling, inflammation, and bleeding of the gums; blue line on the gums, redness [illegible], [illegible], mercurial tremor, digestive disturbances, localized [illegible] in the muscle [illegible] by [illegible] blue or reddened area, general weakness of the hand and digital extensors, foul breath, corrosion of the teeth, [illegible], sleeplessness and depression or drowsiness and apathy, loss of energy and initiative.	Artificial-flower makers; battery (dry) makers; blowers (felt hats); bronzers; [illegible] (gun barrels); brushers (felt hats); cap loaders; carroters (felt hats); cartridge makers; chlorine makers (electrolytic); color makers; coppers (felt hats); dentists; detonator [illegible]; detonator fillers; detonator packers; [illegible] operators (felt hats); dye makers; [illegible]; battery workers; explosive workers; felt-hat makers; fireworks makers; [illegible] mixers; fur handlers; fur preparers; gold refiners; hardeners (felt hats); incandescent-lamp makers; jewelers; mercury-vapor-lamp makers; mercury bronzers; mercury [illegible]; mercury-salts workers; mercury smelters; mercury-still cleaners; mirror silverers; mixers (felt hats); paint makers; photographic workers; primers (explosives); [illegible]; [illegible] (felt hats); [illegible]; starters (felt hats); steel engravers; stiffeners (felt hats); storage-battery makers; taxidermists; thermometer makers; water gilders; zinc-electrode makers.
30. Methyl alcohol.	Headache, nausea, abdominal cramps, ringing in the ears, muscular prostration, insomnia, delirium, difficulty of breathing, inflammation of the throat and mucous membrane of the air passages, conjunctivitis, serious affections of the retina and optic nerve resulting in blindness, fatty degeneration of the liver.	Aldehyde [illegible]; art-glass workers; artificial-flower makers; artificial-silk makers; [illegible]; bronzers; brush makers; celluloid [illegible]; [illegible] (rubber shoes); [illegible] hats [illegible]; dry cleaners; dryers (felt hats); dye makers; explosives workers; feather workers; felt-hat makers; [illegible]; incandescent lamp [illegible]; furniture polishers; gilders; hardeners (felt hats); incandescent-lamp makers; [illegible]; lacquerers; [illegible]; millinery workers; [illegible] (leather); painters; paint makers; patent-leather makers; perfume makers; photo-engravers; photographers; polishers; shellac makers; shoe-factory operatives; shoe finishers; soap makers; stiffeners (felt hats); stitchers (shoes); type cleaners; varnishers; varnish makers; [illegible]; wood-alcohol distillers; woodworkers.
31. Methyl bromide.	Vertigo, headache, staggering, pallor of the skin, retarded pulse, constipation, irritability, trembling.	Antipyrin makers; dye makers.
32. Naphtha	Headache, vertigo, nausea, vomiting, dyspnea, palpitation, insomnia, hysteria.	Bronzers; chauffeurs; degreasers (fertilizer, leather); dyers; furniture polishers; garage workers; gilders; metal-polish makers; painters; petroleum refiners; polishers; rubber workers; shoe finishers; waterproof-cloth makers; woodworkers.
33. Nitraniline	*See* Aniline.	
34. Nitrobenzol and other nitro compounds of benzol and its homologues.	Icterical skin which gradually becomes cyanotic, methemoglobin formation, general debility, anemia; presence of hematoporphyrin, albumin, and sometimes free poison in the urine; skin eruptions, visual disturbances, dyspnea, odor of bitter almonds in breath.	Aniline makers; dye makers; explosives workers; perfume makers; smokeless-powder makers; soap makers.

J. Poiso[illegible]

Health hazard.	Symptoms, condition, or disease to look for.
35. Nitroglycerin	Severe headache, vertigo, nausea, paralysis of the muscles of the head and eyes as well as of the lower extremities, cyanosis, reddening of the countenance, burning in the throat and stomach, disturbances of digestion, trembling, neuralgia, colic, retarded respiration and heart action, obstinate ulcers under nails and on the finger tips, eruptions on the plantar aspect of the feet and interdigital spaces, with extreme dryness and formation of fissures.
36. Nitronaphthalene.	*See* Nitrobenzol.
37. Nitrous gases and nitric acid.	Irritation of air passages, cough, labored respiration, inflammation of the eyes, corrosion of the teeth, erosion and perforation of nasal septum.
38. Petroleum	Inflammation of the skin, acne, suppurating ulcers, papillomas; pustules and irritation of the Schneiderian membrane; headache and sensory disturbances; affections of the respiratory organs.
39. Phenol	Erosion of the skin, eczema, irritation of respiratory organs, digestive disturbances, symptoms of decomposition of the blood, emaciation, nephritis, gangrene, icterus.
40. Phenyl hydrazine.	Vesicular eruptions on the skin with itching and burning, diarrhea, loss of appetite, granular degeneration of the blood corpuscles, formation of methemoglobin, a sense of general malaise.

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ued.

tions which offer such exposure.

: dye makers.

rs; degreasers (fertilizer, leather); dyers; rs; rarers workers; gilders; metal polish; petroleum refiners; polishers; rubber ; waterproof-cloth makers; wood-

e makers; explosives workers; perfume powder makers; soap makers.

J. Poisons—Continued.

Health hazard.	Symptom, condition, or disease to look for.	Occupations which offer such exposure.
35. Nitroglycerin....	Severe headache, vertigo, nausea, paralysis of the muscles of the head and eyes as well as of the lower extremities, cyanosis, reddening of the countenance, burning in the throat and stomach, disturbances of digestion, trembling, neuralgic colic, retarded respiration and heart action, obstinate ulcers under nails and on the finger tips, eruptions on the plantar aspect of the feet and interdigital spaces, with extreme dryness and formation of fissures.	Explosives workers; nitroglycerin workers; shell fillers.
36. Nitronaphthalene.	*See* Nitrobenzol.	
37. Nitrous gases and nitric acid.	Irritation of air passages, cough, labored respiration, inflammation of the eyes, corrosion of the teeth, erosion and perforation of nasal septum.	Acid dippers; acid makers; acid recoverers; acid transporters; aniline makers; artificial leather makers; bleachers; carroters (felt hats); cartridge dippers; celluloid makers; dimethylaniline makers; dippers (cotton); enamelers; etchers; explosives workers; felt-hat makers; fertilizer makers; fur preparers; galvanizers; glass workers; guncotton dippers; gutta-percha workers; imitation-pearl makers; incandescent lamp makers; jewelers; lithographers; mirror makers; mordanters; nitrators; nitric-acid workers; nitroglycerin workers; photo-engravers; picklers; picric-acid makers; refiners (metals); soda makers; steel engravers; sulphuric-acid workers; tawers; tanners (sulphuric acid); wringers (guncotton).
38. Petroleum......	Inflammation of the skin, acne, suppurating ulcers; pseudomembranes and irritation of the Schneiderian membrane; headache and sensory disturbances; affections of the respiratory organs.	Brewers (use benzin); leather workers; furniture polishers; lampblack makers; millinery workers; oil-flotation-plant workers; oil-well workers; paraffin workers; petroleum refiners; tempers.
39. Phenol..........	Erosion of the skin, eczema, irritation of respiratory organs, digestive disturbances, symptoms of decomposition of the blood, emaciation, nephritis, gangrene, icterus.	Bakelite makers; calico printers; coal-tar workers; dye makers; dyers; etchers; gas (illuminating) workers; gas purifiers; lampblack makers; picric acid makers; rubber workers; smokeless powder makers; stillmen (carbolic acid); surgical-dressing makers; wood preservers.
40. Phenyl hydrazine.	Vesicular eruptions on the skin with itching and burning, diarrhea, loss of appetite, granular degeneration of the blood corpuscles, formation of methemoglobin, a sense of general malaise.	Antipyrin makers; dye makers.

J. Poisons—Continued.

Health hazard.	Symptom, condition, or disease to look for.	Occupations which offer such exposure.
41. Phosgene	Destruction of lung tissue, emphysema and edema, myocardial insufficiency due to the emphysema, pleural thickening and adhesions, chronic bronchitis, mild diffuse bronchiectasis, nocturnal dyspnea, polycythemia.	Dye makers; phosgene makers.
42. Phosphorus	Inflammation and sclerosis of the bones and of the periosteum, necrosis of the bones of the jaw, swelling and ulceration of the gums and buccal membrane, loosening and falling out of the teeth, suppuration and destruction of jawbone with fistulous channels burrowing through the cheek, meningeal inflammation, brittleness of bones, digestive disturbances, emaciation.	Boneblack makers; brass founders; fertilizer makers; fireworks makers; insecticide makers; match-factory workers; phosphate-mill workers; phosphor-bronze workers; phosphorus-compounds makers; phosphorus extractors.
43. Phosphuretted hydrogen.	Oppressed feeling in the chest, headache, vertigo, tinnitus aurium, general debility, loss of appetite, great thirst.	Acetylene makers; ferrosilicon workers; phosphorus extractors; phosphorus (red) makers.
44. Picric acid	Itching, inflammation of the skin, vesicular eruptions, yellow pigmentation of epidermis and conjunctiva, inflammation of buccal mucous membrane, digestive disturbances, vertigo, jaundice, nasal catarrh, nephritis.	Dye makers; dyers; explosives workers; photographers; picric acid makers; shell fillers; smokeless-powder makers.
45. Sulphur chloride.	Symptoms are due to the combined effects of chlorine, hydrochloric acid and sulphur dioxide. Sulphur chloride when in contact with moisture reacts with water to form these products.	Rubber-substitute makers; vulcanizers.
46. Sulphur dioxide.	Irritation of the mucous membranes of respiratory organs and eyes, spasmodic cough, bronchial catarrh, digestive disturbances, blood-tinged mucous.	Alkali-salt makers; blast-furnace workers; bleachers; brass founders; brick makers; bronze makers; carbolic acid makers; chambermen (sulphuric acid); charrers (zinc smelting); copper smelters; dye makers; fertilizer makers; flue cleaners; fruit preservers; fumigators; glass makers; glue workers; lead smelters; mercury smelters; oil-flotation-plant workers; petroleum refiners; pottery workers; pyrites burners; refiners (metals); rubber workers; storage battery makers; sugar refiners; sulphite cooks; sulphur burners; sulphurers (hops and malt); sulphuric-acid workers; tannery workers; towermen (sulphuric acid); zinc smelters.
47. Sulphuretted hydrogen.	Headache, debility, vertigo, nausea, disturbances of digestion, sallow complexion and emaciation, slowing of the pulse, conjunctival catarrh, tendency to the formation of boils.	Alkali-salt makers; artificial-silk makers; blast-furnace workers; brewers; cable splicers; celluloid makers; dye makers; fertilizer makers; flax-rettery workers; gas (illuminating) workers; gas purifiers; glue workers; hat-factory workers; miners; oil-flotation-plant workers; petroleum refiners; pyrites burners; sewer workers; soda makers; sodium sulphide makers; starch makers; sugar refiners; tannery workers.

J. Poison

Health hazard.	Symptom, condition, or disease to look for.	
48. Sulphuric acid	Inflammation of respiratory organs, injury to teeth through softening of the dentine, chronic catarrh.	Ac
49. Tar	Tar itch, diffuse acne, eczema or psoriasis, loss of appetite, nausea, diarrhea, headache, somnolence, vertigo, albuminuria, edema, ischuria, conjunctivitis, bronchitis.	Ba
50. Tetrachlorethane (acetylene tetrachloride).	Abnormal sense of fatigue, profuse perspiration, general depression and drowsiness, inability to concentrate, hysteria, slight polyuria, dreaming, headache, vertigo, nervousness, insomnia, loss of appetite, constipation, diarrhea, gas in stomach, general abdominal pain, nausea, eructations of gas, vomiting, loss of weight, jaundice, enlarged liver, bile in the urine, abdominal tenderness, increase of mononuclear cells, appearance of many immature large mononuclears, elevation in the white count, slight anemia, slight increase in number of platelets.	Ai (
51. Trinitrotoluol	Nose and throat irritation, obstinate cough, bluish color of the lips and lobes of the ears, yellowing of the whites of the eyes, expectoration of yellow mucous, discoloration—a mixture of lividity and jaundice, rash on the skin, shortness of breath, anemia, palpitation of the heart, bile-stained urine, rapid weak pulse.	Ex

-Continued.

Occupations which offer such exposure.
[illegible]akers; phosgene makers.
[illegible]ck makers; brass founders; fertilizer makers; [illegible] makers; insecticide makers; match-factory workers; [illegible] milk workers; phosphor-bronze workers; phos[illegible] compounds makers; phosphorus extractors.
[illegible] makers; fireworks workers; phosphorus [illegible]; phosphorus (red) makers.
[illegible]kers; dyers; explosives workers; photographers; [illegible]cid makers; shell fillers; smokeless-powder makers.
[illegible]bstitute makers; vulcanizers.
[illegible] makers; blast-furnace workers; bleachers; brass [illegible]; brick makers; broom makers; carbolic acid [illegible]; chamber men (sulphuric acid); charcoal [illegible]; copper smelters; dye makers; fertilizer makers; [illegible] fruit preservers; fumigators; galvanizers; [illegible] lead smelters; mercury smelters; oil-flota[illegible] workers; petroleum refiners; pottery workers; [illegible] refiners (metals); rubber workers; storage [illegible] makers; sugar refiners; sulphite cooks; sulphur [illegible] sulphurers (hops and malt); sulphuric-acid [illegible] tannery workers; tawermen (sulphuric acid); [illegible]
[illegible] makers; artificial-silk makers; blast-furnace [illegible]; cable splicers; celluloid makers; dye [illegible] fertilizer makers; flax-rettery workers; gas [illegible] workers; gas purifiers; glue workers; [illegible]; oil-flotation-plant workers; [illegible] pyrites burners; sewer workers; soda [illegible] sulphide makers; starch makers; sugar [illegible]nery workers.

J. Poisons—Continued.

Health hazard.	Symptom, condition, or disease to look for.	Occupations which offer such exposure.
48. Sulphuric acid..	Inflammation of respiratory organs, injury to teeth through softening of the dentine, chronic catarrh.	Acid dippers; acid finishers (glass); acid mixers; acid recoverers; acid transporters; ammonium-salts makers; ammonium-sulphate makers; artificial-leather makers; beta-still operators (beta naphthol); bessemer men (iron and steel); calico printers; carbolic acid makers; carbonizers (shoddy); cartridge dippers; celluloid makers; chambermen (sulphuric acid); dimethyl-sulphate makers; dye makers; explosives workers; felt-hat makers; fertilizer makers; galvanizers; glass finishers; gun-cotton dippers; hydrochloric acid makers; jewelers; linoleum makers; mercerizers; nitrators; nitric-acid makers; nitroglycerine makers; oil-flotation-plant workers; patent-leather makers; petroleum refiners; phosphorus-evaporating machine operators; picklers; picric acid makers; reclaimers (rubber); salt extractors (coke oven byproducts); shoddy workers; storage-battery makers; sulphuric-acid workers; tallow refiners; tannery workers; temperers; tawermen (sulphuric acid); wire drawers.
49. Tar...............	Tar itch, diffuse acne, eczema or psoriasis, loss of appetite, nausea, diarrhea, headache, numbness, vertigo, albuminuria, edema, [illegible], conjunctivitis, bronchitis.	Battery (dry) makers; briquet makers; brush makers; chimney sweepers; coke-oven workers; cord makers; flue cleaners; gas (illuminating) workers; insulators; paint makers; paraffin workers; pavers; petroleum refiners; roofers; roofing-paper workers; still (coal-tar) cleaners; tar workers; wood preservers.
50. Tetrachlorethane (acetylene tetrachloride).	Abnormal sense of fatigue, profuse perspiration, general discontent and [illegible], inability to concentrate, [illegible], slight [illegible], dreaming, headache, vertigo, nervousness, insomnia, loss of appetite, constipation, diarrhea, gas in stomach, general abdominal pain, nausea, eructations of gas, vomiting, loss of weight, jaundice, enlarged liver, bile in the urine, abdominal tenderness, increase of mononuclear cells, appearance of many [illegible] large mononuclears, [illegible] in the [illegible], slight anemia, [illegible] increase in number of platelets.	Airplane-wing varnishers; artificial-silk makers; tapers (airplanes).
51. Trinitrotoluol.....	Nose and throat irritation, obstinate cough, bluish color of the lips and lobes of the ears, yellowing of the whites of the eyes, expectoration of yellow mucous, [illegible], a mixture of irritability and jaundice, rash on the skin, shortness of breath, anemia, palpitation of the heart, bile-stained urine, rapid weak pulse.	Explosive workers; shell fillers.

J. Poisons—Continued.

Health hazard.	Symptoms, condition, or disease to look for.	Occupations which offer such exposure.
52. Turpentine	Irritation of the mucous membrane of the eyes, nose, and upper air passages; cough, bronchial inflammation; salivation; giddiness, headache, irritation of the kidneys, odor of violets in urine; severe irritation of the skin, eczema, and hardening of the epidermis.	Art-glass workers; cable splicers; calico printers; camphor makers; cementers (rubber shoes); decorators (pottery); dry cleaners; dye makers; enamelers; enamel makers; feather workers; furniture polishers; japan makers; lacquer makers; linoleum makers; lithographers; millinery workers; painters; paint makers; patent-leather makers; printers; rubber workers; sealing-wax makers; shellac makers; transfer workers (pottery); turpentine extractors; varnish makers.

SKIN IRRITANTS.

Because of the fact that dermatoses form such a large proportion of all occupational diseases and are often disabling, the more important occupations that are exposed to skin irritants have been listed separately. A complete enumeration of such occupations would be impossible. Almost any foreign substance can become a skin irritant if it is in continuous contact with the skin. Thus soap and water, which ordinarily do not irritate the skin, may cause severe dermatoses in washerwomen.

The data presented below are a compilation of the literature on the subject, taken largely from Dr. R. Prosser White's compilation of "Occupational Affections of the Skin."

Skin affections caused by different external irritants often show the same clinical picture. A number of occupational skin eruptions have no specific lesions or special pathology, which makes their differential diagnosis very difficult. Most superficial industrial skin diseases show simply a difference in degree of catarrhal inflammation, depending on the intensity of the irritant. For these reasons the symptoms for each irritating substance have not been listed as has been done for the other hazards.

Occupational dermatoses are characterized by their grouping, situation, mode of appearance, spread, and evolution. They crop up in series, retaining their initial type throughout, unless they are secondarily infected. They are most often local, except when they are a differentiating sign of the toxemias. The onset and development are usually sudden. The inflammation is sharply outlined. Exudation is excessive and there is deep-seated edema. The eruption usually predominates on the right side.

There are many cases of dermatitis which are caused by physical agents, such as heat, cold, friction, etc. In this bulletin these conditions are dealt with only as they are related to the hazards listed.

Thus among the symptoms for " light" we find skin eruptions.

The following is the list of the to dermatoses with the irritating

Occupation exposed to

Occupation exposed.	
Acetylene makers	Calcium
Acid workers	Acids.
Alkali-salt makers	Caustic
Artificial-flower makers	Caustic
Bakelite makers	Formald
Barbers	Soap, h
Battery (dry) makers	Acids, s
Beatermen (paper and pulp)	Caustic
Bleachers (cloth)	Acids, b sodium
Bleeders (tannery)	Dyes.
Bobbin carriers	Nitrobe sodium
Bricklayers	Lime.
Brassers	Dyes.
Broom makers	Dyes, v
Calico printers	Dyes.
Candy makers	Sugar.
Cap loaders	Mercury
Carbide makers	Calcium
Carbolic-acid makers	Caustic
Cardboard makers	Sodium
Carroters (felt hats)	Acids, m
Cartridge dippers	Acids, s
Celluloid makers	Dyes.
Cementers (rubber shoes)	Benzine,
Cement workers	Lime.
Cloth preparers	Acids, s sodium
Confectioners	Sugar.
Cotton sizers	Acids, s
Curriers (tannery)	Paraffin,
Dampers (conditioning cotton)	Nitrobe sodium
Dentists	Procain,
Detonator dressers	Mercury
Detonator fillers	Mercury
Detonator packers	Mercury
Disinfectant makers	Formald
Druggists	Bromide,
Dye makers	Acids, b dines, calcium gums,
Dyers	Dyes.
Electroplaters	Acids, b nickel
Embalmers	Formald
Engravers	Acids, ca
Etchers	Acids, ca
Explosives workers	Dye inte bromin
Felt-hat makers	Acids, m
Fish dressers	Brine.
Flax spinners	Lime, b
Furniture polishers	Benzine, pyridin
Fur workers	Dyes.
Galvanizers	Ammoni
Gas-mantle impregnators	Thorium
Glass blowers	Charcoal,
Glass makers	Caustic
Ink makers	Dyes.

—Continued.

Occupations which offer such exposure.
[illegible] workers; cable splicers; calico printers; camphor [illegible]; cementers (rubber shoes); decorators (pottery); [illegible] dye makers; engravers; enamel makers; [illegible] workers; furniture polishers; japan makers; [illegible] makers; linoleum makers; lithographers; millinery [illegible] painters; paint makers; patent-leather makers; [illegible] rubber workers; sealing-wax makers; shellac [illegible]; transfer workers (pottery); turpentine extractors; [illegible] makers.

ITANTS.

ses form such a large proportion often disabling, the more impor- to skin irritants have been listed on of such occupations would be stance can become a skin irritant the skin. Thus soap and water, kin, may cause severe dermatoses

compilation of the literature on R. Prosser White's compilation Skin."

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erized by their grouping, situ- l evolution. They crop up in throughout, unless they are often local, except when they ias. The onset and develop- mation is sharply outlined. ep-seated edema. The erup- sid-.

are caused by physical In this bulletin these condi- elated to the hazards listed.

Thus among the symptoms for "Extreme dry heat" and "Extreme light" we find skin eruptions.

The following is the list of the more common occupations exposed to dermatoses with the irritating substances concerned:

Occupation exposed to specified skin irritants.

Occupation exposed.	Skin irritants.
Acetylene makers	Calcium carbide.
Acid workers	Acids.
Alkali-salt makers	Caustic alkali.
Artificial-flower makers	Caustic alkali, dyes.
Bakelite makers	Formaldehyde, phenol.
Barbers	Soap, hair tonics.
Battery (dry) makers	Acids, zinc chloride, ammonium salts, charcoal.
Beaters (paper and pulp)	Caustic alkali, dyes.
Bleachers (cloth)	Acids, bleaching powder, caustic alkali, hydrogen peroxide, sodium silicate.
Blenders (tannery)	Dyes.
Bobbin cutters	Mirbanol, aluminum salts, formaldehyde, magnesium salts, sodium fluosilicate.
Bricklayers	Lime.
Brewers	Dyes.
Broom makers	Dyes, vegetable dust.
Calico printers	Dyes.
Candy makers	Sugar.
Cap loaders	Mercury compounds.
Carbide makers	Calcium carbide.
Carbolic-acid makers	Caustic alkali, phenol.
Cardboard stickers	Sodium silicate.
Carroters (felt hats)	Acids, mercury compounds.
Cartridge dippers	Acids, soap.
Celluloid makers	Dyes.
Cementer (rubber shoes)	Benzine, coal-tar products, naphtha, methyl alcohol.
Cement workers	Lime.
Cloth preparers	Acids, caustic alkali, lime, soap, potassium salts, sodium salts, sodium silicate.
Confectioners	Sugar.
Cotton sizers	Acids, zinc chloride, arsenic salts, phenol.
Curriers (tannery)	Paraffin, benzine.
Dampers (conditioning cotton)	Mirbanol, aluminum salts, formaldehyde, magnesium salts, sodium fluosilicate.
Dentists	Procain.
Detonator cleaners	Mercury compounds.
Detonator fillers	Mercury compounds.
Detonator packers	Mercury compounds.
Disinfectant makers	Formaldehyde.
Druggists	Bleaching powder, soap, iodoform, sodium salts, sugar.
Dye makers	Acids, benzine, caustic alkali, coal-tar products, dye intermediates, dyes, turpentine, antimony compounds, barium salts, calcium salts, cresol, dextrine, ferrocyanides, formaldehyde, gums, hydroquinone, lead salts, phenol, potassium chlorate.
Dyers	Dyes.
Electroplaters	Acids, benzine, caustic alkali, lime, potassium cyanide, soap, nickel sulphate.
Embalmers	Formaldehyde.
Engravers	Acids, caustic alkali, ferric chloride, potassium cyanide.
Etchers	Acids, caustic alkali.
Explosives workers	Dye intermediates, explosives (TNT, etc.), ammonium salts, bromine, mercury compounds.
Felt-hat makers	Acids, mercuric nitrate, dyes.
Fish dressers	Brine.
Flax spinners	Lime, brine.
Furniture polishers	Benzine, caustic alkali, naphtha, turpentine, methyl alcohol, pyridine, resin.
Fur workers	Dyes.
Galvanizers	Ammonium chloride.
Gas-mantle impregnators	Thorium compounds.
Glass blowers	Charcoal, pitch, resin.
Glass mixers	Caustic alkali.
Ink makers	Dyes.

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Occupation exposed to specified skin irritants—Continued.

Occupation exposed.	Skin irritants.
Lampblack makers	Soot.
Laundry workers	Caustic alkali, soap.
Lime burners	Lime.
Lime pullers (tannery)	Lime.
Linoleum makers	Dyes.
Machinists	Cutting compounds, lubricants, oils.
Masons	Lime.
Match-factory workers	Dyes, dextrins, gums.
Mercerizers	Acids, caustic alkali.
Mixers (rubber)	Accelerators (hexamethylenetetramine).
Mordanters	Acids, caustic alkali, chromates, zinc chloride, aluminum salts, antimony compounds, arsenates, chromium salts, copper salts, iron salts, lead salts, phosphates, silicates, tin salts.
Mottlers (leather)	Dyes.
Nickel platers	Zinc chloride, nickel sulphate.
Nitroglycerin makers	Acids, explosives.
Packing-house employees	Brine.
Painters	Acids, caustic alkali, paints, zinc chloride.
Paint makers	Paints.
Paper-box makers	Glue.
Paraffin workers	Paraffin.
Parchment makers	Zinc chloride.
Pencil (colored) makers	Dyes.
Petroleum refiners	Caustic alkali, paraffin.
Photographers	Acids, caustic alkali, chromates, metol, pyrogallic acid, turpentine, amidol, bleaching powder, hydroquinone, rodinal.
Photographic plate cleaners	Caustic alkali.
Pitch workers	Pitch.
Plasterers	Lime.
Polishers	Caustic alkali, naphtha.
Polishers (silver and brass)	Potassium cyanide.
Printers	Ink, benzine.
Rock-salt workers	Brine.
Rope makers	Oil, tar.
Rubber workers	Accelerators (hexamethylenetetramine).
Salt preservers	Brine.
Scratch brushers (electroplating)	Acids, benzine, lime, oils.
Shell fillers	Explosives (TNT, etc.).
Shoe finishers	Benzine, coal-tar products, naphtha, methyl alcohol.
Sizers (cotton)	Zinc chloride, aluminum salts, calcium salts, magnesium salts.
Soap makers	Caustic alkali, soap, vegetable oils, sodium silicate.
Sodium hydroxide makers	Caustic alkali.
Solderers	Acids, zinc chloride.
Sugar refiners	Sugar.
Tannery workers	Acids, lime, sodium sulphide, arsenic salts, brine, calcium hydrosulphide, chromium salts.
Tawers	Oil, brine.
Tinners	Zinc chloride.
Tobacco rollers	Vegetable dust, vegetable oils.
Tube layers (cotton conditioning)	Mirbane oil, aluminum salts, formaldehyde, magnesium salts, sodium fluoride.
Typists	Carbon paper.
Vulcanizers	Accelerators (hexamethylenetetramine).
Washers	Caustic alkali.
Washwomen	Caustic alkali, soap, sodium salts.
Watchmakers	Potassium cyanide.
Waterproofers (paper)	Paraffin.
Wax-ornament makers	Dye intermediates, potassium cyanide.
Web-bobbin winders	Lime, aluminum salts, formaldehyde, magnesium salts, sodium fluoride.
Wood preservers	Tar, zinc chloride.
Zinc-chloride makers	Acids, zinc chloride.

HEALTH CONDITIONS

Health conditions of the Navy d
were excellent. The annual admis
Navy, for the four-week period endi
per annum, as compared with 576 p
week period ending September 9.

There has been little change in t
nicable diseases; the annual admissio
ending October 7 was 49 per 1,000,
for the five-week period ending Septe

The following table gives the ann
certain communicable diseases for th
1922, in comparison with the mean
of September, for the four-year pe

Cerebrospinal fever	
Diphtheria	
German measles	
Influenza	
Malaria	
Measles	
Mumps	
Pneumonia	
Scarlet fever	
Smallpox	
Tuberculosis	
Typhoid fever	

There were 173 admissions with de
tember, 139 occurring in insular a
United States, and 17 among the fo
for pneumonia is somewhat higher t
two or three months, the rate for th
tober 7 being 1.5 per 1,000 per annu
measles, mumps, or scarlet fever has
four weeks, either ashore or afloat.

There has been a decided increa
disease during the past two months,
cases, entire Navy, for the four-w
being 103 per 1,000 per annum. T
nereal diseases for the entire Navy
passed is now 118 per 1,000 per annu

EXHIBIT E

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HANDBOOK

OF THE

HOSPITAL CORPS

UNITED STATES NAVY

1939

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DEFENDENT'S
EXHIBIT
Buffalo Pumps
14

BUREAU OF MEDICINE AND SURGERY,
NAVY DEPARTMENT,
Washington, D. C., July 1, 1939.

The Handbook of the Hospital Corps, United States Navy, 1939, is a revised edition of the former Handbook of the Hospital Corps, United States Navy, 1930, and is compiled from articles prepared by members of the Medical, Dental, Hospital, and Nurse Corps, U. S. Navy, and reviewed and revised by Commander W. J. C. Agnew, Medical Corps, and Chief Pharmacist N. L. Saunders, U. S. Navy. It is published for the instruction and guidance of members of the Medical Department of the United States Navy and for use at the Hospital Corps Schools.

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ROSS T. MCINTIRE,
Surgeon General, U. S. Navy.

Medicine and Surgery,
Navy Department,
Washington, D. C., July 1, 1939.

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spital Corps, United States Navy,
red by members of the Medical
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Ross T. McIntire.
Surgeon General, U. S. Navy.

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FOREWORD

In this 1939 edition of the Handbook of the Hospital Corps, U. S. Navy, the subject matter has been revised, enlarged, and brought up-to-date, as nearly as possible, with the sciences which are briefly discussed in the various chapters and sections.

The handbook is intended to serve as a general guide and reference book for the hospital corpsmen of the Navy, especially those performing duty independent of medical officers, and as a textbook for their instruction in the Hospital Corps Schools and elsewhere. It contains information and instructions concerning the duties of the Hospital Corps of the Navy, but hospital corpsmen, particularly those in the upper ratings, are urged to make frequent reference to the U. S. Navy Regulations, the Manual of the Medical Department, U. S. Navy, the manuals of other Navy Department bureaus, circular letters, etc., for additional information and instructions.

The principal subjects have been arranged in the order in which they occur in examinations for advancement in rating. As these subjects necessarily are presented in epitomized form, readers of the handbook should realize that the information contained in it must be supplemented by reference to the standard textbooks and professional journals usually available in the medical libraries of hospitals, ships, and stations.

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It should always be remembered that diseases that have attacked more than half the men of the country during youth, diseases that bring misery to thousands of children and suffering to hundreds of thousands of women innocently infected, and that are incurred almost exclusively through promiscuous sexual intercourse, are diseases to be avoided. It should also be remembered that the man who practices promiscuous cohabitation almost invariably contracts one of the venereal diseases, sooner or later, in spite of every precaution. And if sufficient moral stamina to resist sexual temptation is not possessed, then it must be remembered to take prophylactic treatment as soon as possible after exposure.

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Section 5.—INDUSTRIAL MEDICINE AND INDUSTRIAL HAZARDS

Industrial Medicine is that branch of medicine which deals with the prevention of diseases and injuries among industrial workers. Strictly speaking, industrial medicine has become of such importance in late years, that it is not now limited to workers, but endeavors to promote good health and increase the life span of the entire people.

Its purposes or aims are to insure good health, the prevention of avoidable accidents, to alleviate unnecessary suffering and thereby provide contentment and promote more efficient work. It further deals with the rehabilitation of diseased and injured persons and reclassifies them to work in such positions as their disabilities will permit, thereby obviating the necessity for their becoming public charges and insuring them a livelihood.

Industrial Medicine is akin to Hygiene and Sanitation and Preventive Medicine, but spreads out to embrace accident prevention as well. Its aims are accomplished by endeavoring to reduce the health and accident hazards to a minimum by education, safety devices and precautions, periodic physical examinations, cooperation of employees, and by the passage of laws for the protection of the workers.

The need for the development of this branch of Medicine is apparent to all, when it is known that in the sixteenth century the average life expectancy of the working man was 22 years, as compared to 44 years for those of the upper classes. The working men were really slaves. They worked from 12 to 20 hours daily, 7 days a week. They were subjected to forms of health hazards about which little or nothing was known. The death of the men was considered a natural course of events.

The value of Industrial Medicine to the workers has been clearly manifest. Today, the average working man in industry may well expect to live to the age of 50 with still a better outlook for the future when the hazards to health and accident are better understood and safety measures are developed and perfected to protect against such hazards.

In this country today, every employee is protected by laws which require that certain standards of protection be maintained against health and accident hazards. Compensation laws are in force to require the payment of disability benefits to those incapacitated by accident or disease which were connected with their employment.

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A National Safety Council was established in 1912 and its slogan of "Safety First" has become a by-word in all homes. In 1914 a health section composed largely of Industrial Surgeons, was incorporated as part of the association. Thus the need of medical advice in industry was established. It is a well-recognized fact that the "human machine" constitutes a very definite hazard to health and accident. The medical man therefore must form a definite part of any industrial organization. Today, the National Safety Council in America is one of the greatest organizations of its kind and by its help has put the working conditions in this country on a very high plane and the industrial worker has reaped the benefits.

Today, every industry in this country, no matter how large or how small, has its medical staff, or its equivalent. Many large industries have their own hospitals and medical staffs; others have contract surgeons but all are required in one form or other to give medical attention to the employees under them. The Government having passed such laws must therefore lead the way in protecting its own employees. The United States Navy is one of the largest of the industries maintained by this Government. An organization has been set up in the Navy to protect its personnel, both civilian and naval. A safety engineer is provided, who acts directly under the Assistant Secretary of the Navy. He has supervision of the safety precautions taken to protect the civilian employees in the navy yards, ammunition depots, torpedo stations and the like. He is also a consultant in all matters pertaining to safety aboard ships, at training stations and other Navy Department activities. A naval medical officer is assigned to his office for the purpose of consultation in all matters pertaining to health and safety and to cooperate in devising means by which health may be protected and accidents prevented. Aside from this particular medical officer, all medical officers, dental officers, members of the Hospital Corps and nurses form the balance of the medical staff of this organization. It is essential that each one of these members know and understand the hazards to be encountered in the Navy, the steps to be taken to protect against injury and disease, the treatment of diseases and injuries arising therefrom and the organization of the medical personnel for such purposes. Naval medical personnel are required to perform duties ashore, at sea, in foreign countries, in the air and under the sea. In each of these places a variety of health hazards exist. It is therefore necessary that this personnel have a thorough knowledge of the industry to which they are attached, the hazards presented, the methods of prevention and the treatment of all injuries occurring.

An occupational hazard is any condition, existing in the trades, which will lead directly or indirectly to disease or injury. No method can be devised for classifying hazards for they are too numerous. However, they may be grouped under the following headings:

1. Those hazards present in the working force by reason of physical defect.
2. Those hazards found in the working places, including hygienic and sanitary defects, mechanical defects of machinery, lack of safety education and the like.
3. Those hazards presented by carelessness of employees. A large majority of accidents are due to this cause alone.
4. Those hazards due to unforeseen influences such as lightning, earthquake, tornado, and the like.

Industrial accidents may be prevented by an understanding of the hazards presented in the foregoing groups, by:

1. Thorough physical examination of all new employees, prior to their actual employment, to discover potential physical defects which would render the em-

ployee a hazard to himself or others. An example of this would be a person with manifestly defective vision being employed as a machinist. Physical examination of all regular employees periodically, to determine their ability to continue working at their trade and to reclassify them to less hazardous work or to retire them, as found necessary in individual cases. Repeated examination of all employees engaged in hazardous trades such as sandblasting, painting, chrome plating, T. N. T. handling, and others, to determine any possible systemic effects present as a result of their trade.

2. A constant and thorough inspection of all shops and working places by the safety engineer, the medical officer, and their assistants to determine the causes of accidents, the hazards to health and the immediate correction of these faults. Education of the employees by means of lectures, motion pictures, posters, and such, will further accomplish much in the line of prevention.

3. The prevention of carelessness by indoctrination of all employees with the spirit of prevention and building up a spirit of cooperation and high morale among them. If necessary, disciplinary measures should be taken when workers are habitually careless.

4. Providing, in so far as is possible, means of protection and escape in cases of disaster.

An exact classification of occupational diseases is difficult, in view of the great number and types of diseases presented by the industry. There is such a great variety and number of skin diseases in the trades that they are generally grouped under the heading of *Occupational or Trade Dermatoses.* It is sufficient to state here that practically all diseases and injuries may be associated with industry.

To successfully carry out the objects of Industrial Medicine the medical personnel of the Navy must know:

1. The organization of a safety unit of an industry and the duties of each of the personnel.

2. The hazards to health and accident presented by the particular industry to which they are attached.

3. The methods and means of protection to be established against the encountered hazards.

4. The treatment of industrial diseases and injuries.

5. The laws relating to compensation and treatment of sick and injured personnel, including a knowledge of the necessary reports and returns to be submitted in such cases.

For the purpose for which this book is intended, it seems sufficient to give the hospital corpsmen a general idea of the organization, hazards, protection, treatment and laws as related to the Navy, rather than to try to discuss Industrial Medicine as a whole. This may well be done by discussing the safety organization and its associated duties at a navy yard, for those in force at navy yards are applicable to a greater or lesser degree throughout the Navy. These will be considered in the order given.

Organization.

At all navy yards, the Commandant is the head of the organization. He is responsible to the Navy Department for the protection of the employees, as well as the naval personnel, under his command. He is familiar with the nature of the work being performed by the employees at his station and the health and accident hazards presented. Accordingly, he appoints, as the working head of the organization, a safety officer or a safety engineer, as he is better known. The safety engineer must be of sufficient rank and service to have

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become familiar with the various trades in a navy yard, a knowledge of machinery, a man of cooperative ability and well liked, and having sufficient knowledge of safety devices and appliances to intelligently make inspections and recommend proper protective measures. His duties are primarily, to prevent accidents and promote healthy working conditions. It is his duty to inspect all working places, make a general survey of all mechanical conditions and to recommend the addition of all necessary safety appliances for the protection of the workers. He must make daily inspections of the shops to see that these safeguards are in working order and are being used. He must investigate all major accidents in order to determine the cause and recommend methods to prevent a similar accident. There should be full cooperation between him and the medical officer. All improvements come under his supervision.

The Commandant further assigns a medical officer to act as advisor to the safety engineer. The medical officer must be of the same qualifications as the safety engineer, with the addition that he must be thoroughly versed in the diseases connected with Industry. He need not have a thorough knowledge of machinery but must understand sufficient of the operation of the various machines to intelligently advise the safety engineer in matters relating to the development of safety devices. The duties of the medical officer are as follows, and in this connection it is well for members of the Hospital Corps to understand the nature of these duties in order that they may be of assistance to him in the performance of these duties:

The medical officer is the safety engineer of the human body. He acts as consultant to the safety engineer in all matters pertaining to the general welfare and health of the employees. Hygiene and sanitation are his important duties. He must interest himself in the employees and instruct them in the every day principles of personal hygiene and self preservation. He must instruct the employees in safety measures and encourage them to cooperate in protective measures. They must be made "safety conscious" or "safety minded". The morale must be kept up. A high morale leads to fewer accidents and better workmanship. The medical officer must inspect all working places in order to have a better understanding as to the actual conditions under which the men work. He must make appropriate recommendations to improve deficiencies noted and must then see that these recommendations are carried out. He must personally make all physical examinations of prospective employees or see that the physical standards for employment are adhered to. He must make physical examinations of all employees believed to be physically unfit for further work to prevent them from injuring themselves or others. He must further treat and view the scene of all accidents to be able to determine their cause and to assist the safety engineer in formulating plans to prevent recurrences. He must so organize the personnel under him that prevention will be effectively handled.

The safety engineer is assisted in his work by the foremen of the shops and in some instances by safety committees in each shop elected by the employees. These men or committees are generally chosen from among the older employees and from men who have considerable experience in their trade. It has been repeatedly recommended, but not as yet accomplished, that the safety organization be enlarged by the creation of two new civil service ratings. These are, a civilian safety engineer and a civilian assistant safety engineer. These men would be appointed by competitive examination and should be men who have had considerable experience in the trades with a liberal understanding of all. They would act as assistants to the naval safety officer and would be of great value to the organization, inasmuch as their duties would be permanent. A

naval officer is subject to change of duty and cannot act as permanent safety officer. In changing the safety officers at intervals a weakness is left in the organization which the civilian assistants could well fill, until such time as the new officer became familiar enough with his new duties to take hold.

The organization of the medical advisor is composed of junior medical officers, dental officers, to some extent, members of the Hospital Corps, and of nurses. The duties of the hospital corpsmen are to assist the medical officer in his inspections, assist in the treatment of the injured and to prepare the necessary reports and returns in cases of accident, occupational disease, and the physical examination of employees. This, then, is briefly the organization of a safety unit in a navy yard. This unit will function as well aboard a battleship or in other places. The commanding officer of a ship is the head of the organization. He is assisted by the First Lieutenant acting as safety engineer. Division Officers act as assistants to the First Lieutenant and safety committees are elected in each division from among the crew. The medical officer is the adviser to the safety engineer and he in turn is assisted by the dental officer and hospital corpsmen. All then that is necessary for the unit to function is that a study be made of the hazards presented aboard ship and to proceed as explained later.

Hazards to health and accidents.

The organization completed, a study must be made to determine the hazards ...ting in the particular organization to which the unit is attached. There ... major hazards and minor hazards. A major hazard is represented by unguarded machinery or improperly or faulty insulated electrical wiring. A minor hazard is a greasy shop floor, loose articles lying around on the deck or an open, unguarded hatchway aboard ship. It must be remembered that no two industries present the same hazards. There are hazards peculiar to each trade or profession. Efforts must therefore be made by the safety organization to locate these hazards and afford protection accordingly. To indicate just what types of hazards may be encountered while working with a safety unit of a navy yard and in an effort to make the subject of hazards a little clearer to the readers the following questionnaire, prepared by the inspector of the Medical Department Activities of the West Coast is quoted in part. This questionnaire represents a very thorough picture of the major hazards with which a safety unit of a navy yard must cope, aside from the many minor ones always present in any organization. Answers to these questions must be made not only to the inspecting officer but they must in some form or other be answered daily if the organization is to be successful. By this is meant that problems of this nature are a daily occurrence and the safety unit must be prepared to meet them at once and not wait to formulate answers at inspection intervals.

"Q. 1. What industrial processes employ lead at some stage of the work? This includes tetraethyl lead. How many workers are exposed to lead? What precautions are taken to prevent damage to workers using lead? How frequently are workers using lead checked to determine possible absorption of this element?

"Q. 2. What industrial processes employ chromium at some stage of the work? What precautions are employed to safeguard workers from chromium poisoning?

"Q. 3. What processes create a possible dust hazard? What precautions are observed to prevent damage to workers exposed to dust? Are routine examinations made of the chests of workers exposed to dust? Are X-rays made to de-

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termine the presence of silicosis in workers exposed to dust? Have cases of silicosis developed?

"Q. 4. What industrial processes produce fumes which may be a health hazard? How are these fumes controlled?

"Q. 5. What industrial processes produce carbon monoxide in possible dangerous concentrations? What industrial processes produce carbon dioxide in possible dangerous concentrations? Have any cases of poisoning from these sources occurred?

"Q. 6. What processes employ volatile solvents during some stage of the work? Are aniline compounds used? Has damage occurred from their use?

"Q. 7. Are organic wax compounds used? Has damage occurred?

"Q. 8. What precautions are exercised to prevent damage from pipe covering compounds? What asbestos hazards exist?

"Q. 9. What precautions are taken to prevent damage from glass wool?

"Q. 10. What radio-active compounds are used on the station and what precautions are used to prevent damage from this and luminous paints?"

These are but a few of the questions asked but they serve the purpose for which they were intended, i. e., to indicate just what is meant by a health hazard and ones which must be studied in Industrial Medicine.

Protection.

Having made a survey to determine the hazards presented in the organization to which one is attached, means of protection must be sought. This is done first by protecting against physical hazards by employing physically fit men. In the Government, the physical standards are set according to the employment and the hazards to be met with in each type of work. The U. S. Civil Service standards are as follows:

1. For employment in arduous duties. Must be physically sound and in good health, active and able bodied. Rating "A". For some positions e. g. divers, requirements are specially rigid. Rating "A plus".

2. For less arduous employment. Requiring sound general health but less physical strength, though for some employment special requirements exist, i. e. perfect color preception for brakemen and chauffeurs. Rating "B".

3. For lighter and usually sedentary employments. General good health but minor anatomical defects not interfering with efficient performance of work may be passed, i. e. a typist may be lame.

Next, having employed a healthy working force it is necessary to protect their health. Proper working places must be provided and maintained. Hygienic and sanitary conditions must be kept on a high plane. All moving parts of machinery must be guarded; goggles provided for workers required to use them; helmets and masks for sand blasters; proper ventilation for the chrome workers; masks for asbestos workers; protection for workers in X-ray and radium; protective gloves, shoes, and other garments for foundry workers, and other means of protection too numerous to mention here must be available and used.

Special physical examinations must be made of all sand blasters, asbestos handlers, those exposed to radium and its compounds, lead workers, those engaged in dusty or smoky trades, handlers of T. N. T. and other explosives, etc., to prevent the occurrence of the diseases associated with those trades from injuring the men.

As mentioned before, all workers who are sick for any length of time and whose efficiency has fallen off because of physical reasons must be examined and either retired or reclassified.

Treatment.

The treatment of industrial diseases and injuries is essentially that for any others. All accidents are treated according to the severity and locality. Men are not allowed to treat themselves for even minor accidents by reason of the dangers of infection and later incapacity. The treatment of diseases of occupation is a specialty in itself and need not be considered here.

Laws governing workers and accidents occurring during work.

The laws governing occupational diseases and injuries are quite numerous. It is therefore essential that a hospital corpsman be familiar with only those pertaining to Government employees. These, in general, are as follows:

All men injured or taken sick during the course of their employment are required to report to the dispensary for treatment. It makes no difference how trivial the accident or how minor the illness, he must still report. No first-aid boxes are allowed in any of the shops or offices. When a man reports, his injury or illness is investigated, treated, or otherwise disposed of. At the U. S. Navy Yard, Puget Sound, Wash., a form report of the case is prepared in quintuplicate, two copies of which are forwarded to the safety engineer, one copy is sent to the foreman of the shop or the supervisor of the office, one is given to the employee, and one placed in his file jacket. A separate file jacket is maintained for each employee who reports to the dispensary for treatment or for any other reason and is a permanent record which is kept during the entire time of employment. The information furnished on this report is as follows: Date; whether report is of injury or return to work; name; rating; pay number; shop; diagnosis; date and hour of injury; date and hour reported to dispensary; whether or not injury is due to employment; disposition (treated and returned to work, given time off, or transferred to naval hospital); name of medical officer treating case; and patient's statement regarding injury.

In addition to this form, a card-index form, U. S. Employees' Compensation Commission Form CA-19, is made out in each case. This form is started when the man reports and when final disposition of the case is made it is likewise filed in the man's jacket.

When an injured employee returns to his shop or office, or when the foreman or supervisor receives his copy of the form report, the foreman or supervisor immediately fills out U. S. E. C. C. Form CA-2, and forwards it to the injury officer, who, in turn, submits it to the dispensary for completion by the medical officer treating the case. The medical officer gets the data for this report from the forms previously described.

U. S. E. C. C. Form CA-3 is forwarded at the termination of total or partial disability of an employee, or upon his death.

U. S. E. C. C. Form CA-4 is a claim for disability allowance or compensation for injuries received which must be submitted by the employee within 60 days after the injury. This form must also be completed by the medical officer attending the case and once again the form report and U. S. E. C. C. Form CA-19 are of value.

U. S. E. C. C. Form CA-8 is similar to Form CA-4 but must be submitted on the first and sixteenth of each month by the employee, during the period of his disability.

When it becomes necessary for an injured employee to have hospital or other treatment not provided by a dispensary or local physician, U. S. E. C. C. Form CA-16 is made out and forwarded with the patient to the hospital or place where he is to receive such additional care.

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Times arise when there is doubt as to the origin of the disability, i. e., whether or not the disability is occupational. In such cases U. S. E. C. C. Form CA-17 is substituted for Form CA-16. Whenever U. S. E. C. C. Forms CA-16 and CA-17 are made out they must be accompanied by U. S. E. C. C. Form CA-20.

U. S. E. C. C. Form CA-21, Discharge Report of Injury Case, is forwarded when an employee is discharged from treatment after having been incapacitated by reason of occupational injury or disease.

U. S. E. C. C. Form CA-83 is a report of hernia and must be submitted in all cases in which claim is made that a hernia was caused by employment.

Numerous other forms, such as public bills for payment for treatment, are used in handling these cases, but as they are accomplished by the injury officer they are not listed here.

Forms showing reports of all physical examinations of employees, including the special examinations previously mentioned, are also kept. These are routine however, and are easily learned when actually engaged in this work. Special forms for W. P. A., E. R. N., and P. W. A. workers are also provided.

In conclusion, it is well to state the qualifications expected of a hospital corpsman engaged in Industrial Medicine.

1. He should realize that his first duty is to the workman who is injured.
2. His personality should inspire confidence.
3. He should have a knowledge of first aid.
4. He should have a knowledge of an efficient medical record system and of statistical methods.
5. He should have a knowledge of sanitation, of working conditions, of occupational hazards and preventive measures.
6. He should possess a general knowledge of industrial relations, including employment, its methods and problems.
7. He should have a working knowledge of the workmen's compensation laws.
8. It would be well for all hospital corpsmen to obtain and read the publication Medical Service in Industry and Workmen's Compensation Laws, 1938, published by the American College of Surgeons as prepared by M. N. Newquist, A. B., B. Sc., M. D., to enhance their knowledge of this subject and thereby be of more value to the medical organization of the Navy for industrial medicine. This publication contains concise, complete statements of the problems of the industrial organization and is of value to all industries.

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Section 6.—FIELD SANITATION

Health is necessary in war, and cannot be replaced by anything else.—Napoleon

Introduction.

The activities of a medicomilitary organization tend to concentrate toward one primary objective, *"The conservation of physical efficiency for combat."* The hospital corpsmen of the Navy serve ashore, as well as afloat, and in

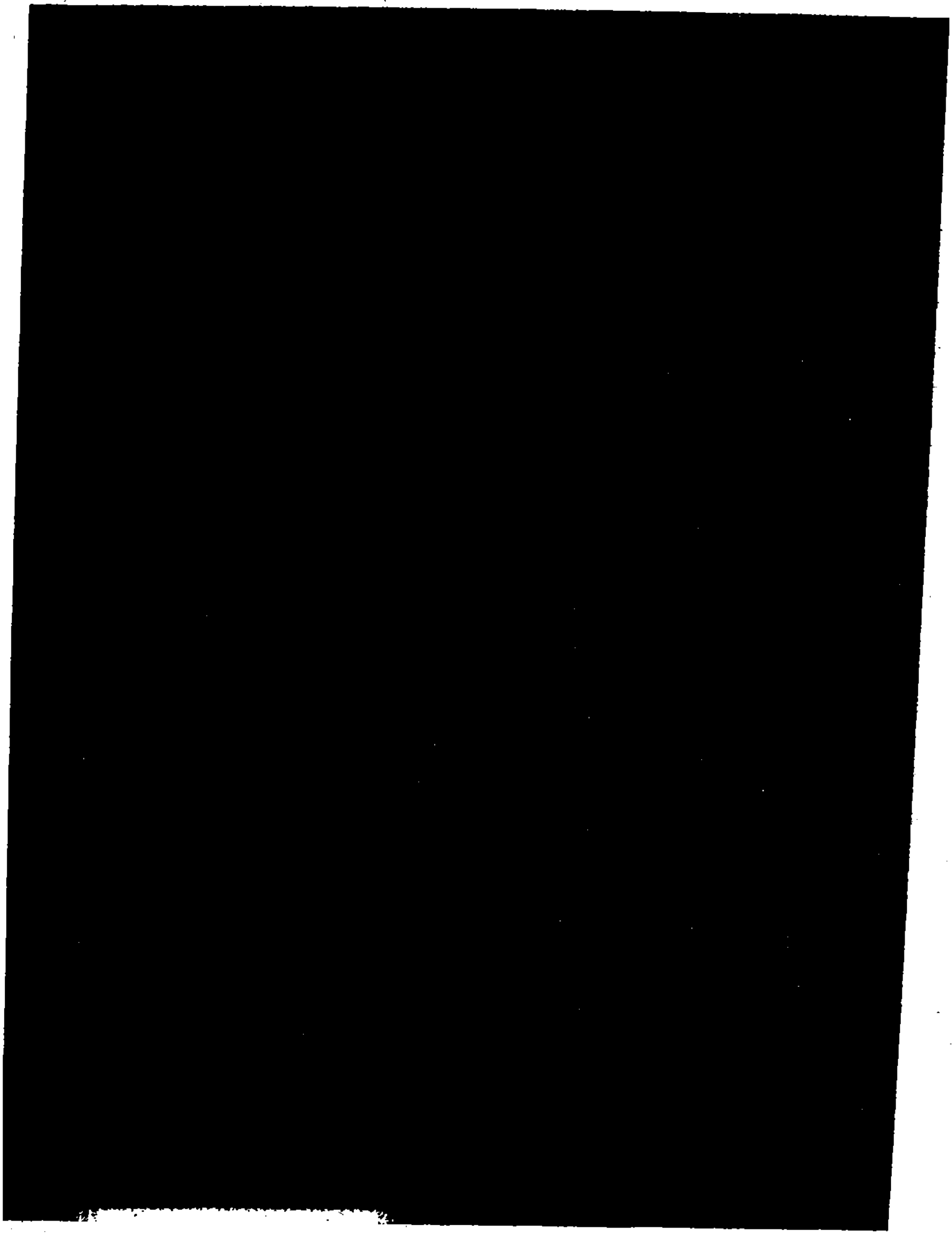

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EXHIBIT F

UNITED STATES NAVY DEPARTMENT
BUREAU OF MEDICINE AND SURGERY

ANNUAL REPORT OF THE SURGEON GENERAL, U. S. NAVY

CHIEF OF THE BUREAU OF MEDICINE AND SURGERY

TO THE SECRETARY OF THE NAVY

CONCERNING

STATISTICS OF DISEASES AND INJURIES IN THE UNITED STATES NAVY

FOR THE CALENDAR YEAR

1939

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UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1941

DEFENDENT'S
EXHIBIT
Buffalo Pumps
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ious action of the light.

INDUSTRIAL MEDICINE

Navy Yard, Charleston, S. C.--In order that claims for industrial injury may be confined to those receiving such injury by reason of their employment in the navy yard, all applicants for trades listed as potentially hazardous, receive a special examination, including X-ray examination of chest, where necessary, prior to their employment or assignment to the hazardous occupation. In addition to the entrance examination, periodical examinations are given during continuance of occupation in such work. This increases the work of the Yard dispensary and involves considerable additional cost to the government by reason of materials expended, but it is believed that the results obtained will prevent any serious industrial injury to the man occupied in hazardous industrial trades and prevent unjust compensation claims to be filed against the Government. As a means of protection to fellow employees and to prevent unjust claims to compensation for injuries alleged to have been received by reason of industrial employment, it is recommended that as a condition of employment all Civil Service applicants be required to have a serological test, with the provision that applicants who show a positive serological reaction but no active lesions, shall be required to have continuous medical treatment until negative serological tests are obtained or the disease is pronounced non-infectious by the Yard medical officer. It is also recommended that where infection occurs subsequent to employment that serological tests be made compulsory. As condition of employment, large private industrial corporations require serological tests prior to employment and at periodic intervals thereafter. If it is found that employees have active syphilitic disease, medical treatment is compulsory unless they are pronounced non-infectious by the company physician. Medical treatment for Civil Service employees could be obtained from private physicians or public clinics, and such treatment could be evidenced by certificates signed by licensed practitioners, but serological examinations should be performed at the Yard dispensary in order that a uniform procedure may be followed.

Puget Sound Navy Yard, Bremerton, Wash.--The average employee of this Navy Yard is safety-minded, and a general spirit of cooperation with regard to accident prevention continues. The safety program has been carried forward with excellent results during the past year, emphasis being placed on education of men through indoctrination of the supervisors. Analysis of representative periods have shown that approximately 90 percent of all accidents are directly attributable to carelessness of the men. The record of 18 lost-time accidents among 5,985 employees as compared with 22 lost-time accidents among 4,022 employees in 1938 is considered very satisfactory.

During the past year the following additional safety measures have been undertaken: (a) a new type of face shield has been obtained for buffing and polishing work which is a great improvement over goggles; (b) new double lenses for helmets have been obtained which are found to be much more satisfactory than the old; (c) salt tablet dispensers have been installed in all shops in which "hot work" is carried on; (d) ventilation of shops and offices has been materially improved, and is continuing to improve as funds become available for projected work; (e) an investigation has shown that men on machine tool work wearing corrective spectacles have only one-eighth the number of foreign body particle eye injuries as compared to men wearing no spectacles. Ordinary cup goggles are unsuitable for most types of machine tool work due to restricted vision. It has been proposed to the Navy Department Safety Engineer that a suitable type of spectacle goggle without side shields be approved for use on these types of machine tool work; and (f) the present Navy specification welding glove has been found to be unsatisfactory, particularly for overhead electric welding. A number of men have been burned due to failure of exposed stitching in this glove. It has been proposed that a more suitable type of glove be approved.

The number of eye injuries among the regular Yard employees was more than double for the calendar year 1938 - 223 for 1938 and 457 for 1939. The increased number of employees can account for some of the increase but the eye injuries have increased out of proportion. Outstanding causes of injuries to the eyes have been poor fitting goggles and failure to use goggles in spite of educational activities on the part of the medical department, injury officer, and supervisors. It is gratifying to note that there were no lost-time eye injuries among the regular Yard force and only one case among the relief workers.

Statistics show a definite increase in all types of injuries among classes of employees except the Emergency Relief, Navy. This increase is out of proportion to the increased personnel and it is believed to be due to the fact that the shop superintendents insist that employees receiving injuries, no matter how slight or insignificant they may seem in extent or severity, report to the Dispensary for treatment. This opinion is supported by the reduction in the actual number of "Injuries resulting in Loss of Time" from 22 during 1938 to 18 during 1939.

Navy Yard, New York, N. Y.--Welding: There are approximately 450 electric welders and 112 gas welders carried on the rolls.

It is well recognized that in the absence of protective measures or with inadequate measures welding incurs certain health hazards, such as toxic gases from the arc of the flame, fumes or dust of metallic oxides of an injurious nature from the coating of certain welding rods, damage to the eyes from ultraviolet rays, etc. The question arises whether or not control protective methods now provided are entirely adequate to prevent occupational diseases in welders under all circumstances.

It was recommended to the Commandant in December 1939, at the suggestion of the Director of the Division of Industrial Hygiene, New York State Department of Labor, that a joint health study of the 930 electric, gas, and tack welders, be conducted by the latter agency and the medical officer of the Yard. The proposed research contemplated medical and occupational histories, physical examinations, and X-ray studies, the funds and bulk of the research staff to be supplied by the New York State Division of Industrial Hygiene.

It was believed that such a study would yield results of great benefit to the workers and that the findings would be significant as a check upon the present methods of control and of value to the U. S. Employees Compensation Commission in relation to certain possible future compensation claims. Other outstanding authorities in industrial hygiene were consulted and all concurred in the view that a large-scale health study of welders was required to settle definitely certain questions relative to hazards of the occupation.

Lead and Lead Compounds: There is little hazard incident to brush painting in this Yard. Lead paint is used chiefly for the red lead priming coat for the hulls of ships. Zinc, titanium or aluminum paints are largely used for other applications. The enamel paints consist of a zinc base in varnish and turpentine. No cases of lead poisoning have come to the attention of the Medical Department during the period un-

der consideration. Metallic lead is handled in the molten state as a component of Babbitt metal in the Inside Machine Shop (No. 31). This metal contains lead, antimony, and copper. The lead volatilizes at a relatively low temperature. The melting kettles are equipped with a hood connected to an air exhaust system with suitable suction fan pipe and conduit to remove fumes which form on the surface of the molten metal. In addition, a respirator is provided for protection against the inhalation of fumes.

Lacquer painting with spray technique is conducted with lacquers made up of a celluloid base with certain volatile solvents, some fast and some slow drying, which may lead to toxic symptoms if inhaled beyond threshold concentrations.

The Ordnance Machine Shop, Electrical Shop, and Sheet Metal Shop are equipped with hoods connected to adequate exhaust systems. In the Ordnance Machine and Sheet Metal Shops a water spray curtain is also provided for more effective removal of fumes. The spray room of the paint shop is not equipped with a hood, dependence being placed upon an exhaust blower for removal of fumes. This lack of localized exhaust results in a much slower rate of removal of contaminated air. No cases of volatile solvent poisoning were reported during the calendar year.

It is recommended that all spray painters be given an annual examination for evidence of toxic effects of volatile solvents.

Industrial Protection Against X-ray and Radium: (a) X-ray protection.--The Pipefitter Shop is equipped with one portable X-ray machine of 220 kilovolts and 25 milliamperes capacity which was installed approximately two years ago. This is employed chiefly for the detection of flaws in pipe-welded joints for high steam pressure installation. The maximum number of exposures approximates a total of 51 minutes a day. (1) Engineering Control: The X-ray tube is encased in lead of 2mm. thickness. The machine is contained in an enclosure 20 feet by 20 feet bounded by a shield 6-1/2 feet high, 10 feet from the tube in all directions and lined with sheet lead 2mm. thickness on three sides. (2) Medical Control: Four men are assigned as operators of the X-ray and radium installations. One of the earliest effects of radiation exposure is a destructive action on the white and red cells of the blood, more marked on the white cells in the early stages. A procedure has been established for a quarterly blood examination of operating personnel and an examination for possible general radiation injury.

(b) Radium Protection.—The use of radium was initiated 4 to 5 years ago for the detection of flaws in castings constructed for high pressure steam installations, both steel and non-ferrous. A capsule containing 278 mgms. of radium is the source of the radiation, the tests being conducted in the Inside Machine Shop. This is in use for an average of 160 to 200 hours a month. The chief metallurgist reports that high speed films exposed at a distance of 12 feet from the capsule for one hour showed no fogging. It is therefore concluded that employees are not subject to harmful radiation at that distance. Protective measures appear adequate.

It is emphasized that a thorough physical examination of a radium or X-ray worker shall be made before he is employed and at any time that the blood count shows suggestive changes or the worker complains of an obscure ailment. The question arises whether the foregoing measures of protection against X-ray radiation are entirely adequate. The situation was recently discussed with the Chairman of the Advisory Committee on X-ray Protection of the Bureau of Standards. [illegible] gested that personnel within the distance of 40 feet external of [illegible] lead [illegible]

workers would probably not receive a damaging exposure, the question of such a possibility demands consideration. The absolute necessity for further protection can be definitely determined by actual measurements of scattered radiation by means of the portable ionization chamber. It is recommended that the advisability of such tests be considered.

Precautions Relative to Pickling of Metals: (a) Building Ways, No. 1.--There are two sets of pickling tanks in this area one for flat steel and one for piping. The acid employed is dilute sulphuric. The question at issue is whether at any stage of operation personnel are subjected to the inhalation of arsine gas or arsenic dust originating as a result of contact with arsenic, present as an impurity of the metal, with nascent hydrogen in the bath. Such a possibility appears extremely remote in view of the fact that the operations are conducted in the open air thus excluding the possibility of rising accumulation of arsenical compounds which might result in an enclosed space. However, it is advisable that the operating personnel be examined semi-annually for possible evidence of arsenic absorption instead of the quarterly examination now prescribed.

(b) Coppersmith Shop.--Both sulphuric and muriatic acids are used in the vats of this enclosed space connected with the coppersmith shop. The possibility of arsenical exposure discussed above also obtains for this space. Forced exhaust ventilation is provided and appears adequate. A semi-annual medical examination of operating personnel is advisable.

Occupational Dust Hazards: (a) The Steel and Brass Foundries.--The chief hazard to be considered is silicosis due to the inhalation of silica dust, the extent of the hazard being dependent upon the concentration, size of the particles, percentage of free silica, and the duration of exposure. Whether or not a silicosis hazard exists in these foundries can only be determined by actual counts of dust particles concentration under the various working conditions and the estimation of free silica in the sand used. It has recently been reported by the New York State Department of Labor that silicosis can be prevented if the average plant concentration does not exceed 15 million parts per cubic foot.

(b) Casting Cleaning Shop.--The conditions in this shop appear to be particularly unfavorable. The iron and brass foundry buildings are equipped with forced exhaust ventilation although its efficiency in controlling dust concentrations is undetermined. The casting cleaning shop, however, is not provided with any mechanical ventilation, dependence being placed mainly on roof cowls, which, it is believed, are inadequate.

Certain of the grinding and chipping operations should be conducted under hoods with localized suction ventilation. Two high-speed emery wheels and two carborundum grinding wheels are not equipped with suction ventilation. It is recommended that consideration be given to a systematic engineering survey of both foundries and the casting cleaning shop to include dust counts and the measures necessary to reduce silicosis hazards.

There are 33 employees in the iron foundry, 84 in the brass foundry, and 22 in the casting cleaning shop. It would be desirable to carry out a medical survey, including X-ray of the lungs, of all personnel in order to determine the incidence of silicosis. For the present, however, it is suggested that such a study be limited to employees in the casting cleaning shop where the worst conditions prevail

All candidates for employment for foundry oper[illegible]s should be given an X-ray examination of the lungs in order to scr[illegible] out cases in,

any state of silicosis.

(c) Sandblasters.--The present practice of an annual X-ray examination of the chest, or oftener if so indicated, will be continued.

(d) Hazard of Buffing and Polishing.--The possible hazard incident to dust from artificial abrasives such as carborundum, alundum, and emery should be considered. The dust from these materials does not contain free silica and therefore will not produce silicosis. However, if breathed for protracted periods, these dusts induce an X-ray appearance similar to that of early silicosis. This picture changes very slightly as length of exposure increases. There is clinical evidence, however, that workers exposed to heavy concentrations of abrasive dust are more susceptible to diseases of the chest than those not so exposed. Authorities in this field advise that an effort should be made to keep the dust count below 20 million particles per cubic foot. The dust is approximately 50 percent abrasive and 50 percent metallic. Although respirators are provided for individual use, it is impracticable to wear such a device constantly.

The buffing and polishing wheels in the Sheet Metal Shop are not equipped with localized exhaust. This is recommended as a safety precaution.

The grinding wheels in the tool room of the Shipfitter Shop are provided with either individual exhaust or are kept constantly wet which reduces to a marked degree the quantity of escaping dust.

Hazard of Asbestosis: Asbestosis is an industrial disease of the lungs incident to the inhalation of asbestos dust for prolonged periods, and is distinct from silicosis. The development of the disease depends upon the concentration of the dust, the size of the dust particles, and the length of exposure. The workers in the Pipe Covering and Insulating Shop are exposed to the inhalation of asbestos dust incident to the cutting of asbestos insulating felt in the fabrication of covers for flanges, valve bonnets, and high temperature steam turbines. The material falls under the trade name of "Amosite."

A medical survey of the 11 employees in this Shop was conducted recently with the object of ascertaining whether asbestosis in any stage could be detected. The history of exposure varied from 1.7 to 17 years, 6 men reporting 10 years or over. Present and past disability attributable to asbestosis was denied by all the men and X-rays of the chest were essentially negative in all cases. However, it was not considered that the negative findings precluded the future development of asbestosis by continued exposure to present occupational conditions. The following recommendation made jointly by the medical officer of the Yard and the safety engineer was approved: Install an exhaust blower over work table in the Pipe Covering and Insulating Shop to remove asbestos dust at the source as a protective measure against the hazard of asbestosis.

Norfolk Navy Yard, Portsmouth, Va.--Considerable work has been accomplished in industrial medicine. The medical officer, safety engineer, and W. P. A. Safety Supervisor work in close consultation. In this manner the medical and technical aspects of each industrial problem is properly coordinated. The Bureau of Medicine and Surgery and the Navy Department Safety Engineer have been consulted on several occasions and have given valuable suggestions.

A special effort has been made to collect literature and data with regard to industrial medicine to be used for reference purposes. Special attention is given to the working conditions in hazardous occupations such as sand-blasting, asbestos pipe-covering, amosite [illegible] fiber-glass insulation. Ventilation, clothing, masks, etc. are c[illegible]d frequently. Routine inspections have revealed that helmets used [illegible]

blasting are of various types. A special study is being attempted with regard to types of masks, helmets, and respirators with the idea of recommending standard items of as near one type as possible.

An extensive study of a new insulating material, fiber-glass, now employed by the Navy, has recently been carried out by this department. Representatives of the manufacturers of this product have been interviewed, and numerous reports of clinical and laboratory investigations have been reviewed. The representatives claim that no harmful effects from the material have been noted among their employees over a period of 6 years, and the only precautions used are loose clothing and a good cleansing shower at the end of each working day. The evidence submitted is not entirely convincing, and the period of time since the introduction of the product is too short to warrant any definite conclusions at present. Until further information is available the following precautions are in effect: The employee must wear hood, respirator, and gloves at all times; the clothing must be loose and cover the arms and neck; goggles must be worn if there is excessive circulation in the compartment; and showers are required before lunch and at the close of the day.

At present the Norfolk Navy Yard has no instruments for making dust counts. The acquisition of at least one of the new and recently improved instruments would be a great advancement in the field of industrial medicine at this Navy Yard and would afford an opportunity for considerable research.

The hazards to civil employees consequent to industrial activity is a problem and requires continued, intense, effort and research with regard to personnel, new materials, new machinery, and new processes. Safety devices and rules should maintain a high standard. This aspect should be studied, developed, and mastered. It requires cooperation in safety engineering and intensive study of industrial health problems.

Naval Torpedo Station, Newport, R. I.--The number of infections following injuries remains low among civil employees at this station. This is due no doubt to the cooperation of all concerned in routing injuries, no matter how trivial, to the dispensary, where they are promptly treated. A follow-up system is also used whereby cases must report for daily observation and redressings until discharged. Many cases of colds, grippe, and bronchitis have developed among the civilian employees during the fall and winter months. By treating these cases three times daily with antiseptic sprays, cough mixtures, and cold capsules, and the prompt checking out of cases with elevated temperatures, an appreciable decline in lost-time incidence has been noted. It is encouraging to note that accidents are on the decline in spite of the increase in employees. By comparative classification we find that in 1935 there were about 4,962 injuries among 2,493 employees and in 1939 about 3,500 injuries among 3,852 employees.

A general physical examination of all workers in explosive materials, including a complete blood analysis and urinalysis, has been done monthly since October, 1939. An effort is being made to prevent occupational poisonings, with particular reference to tetryl and fulminate of mercury. To date no statistical data have been completed. Sand-blasters are examined routinely each month, and routine chest X-rays are done every three months, oftener if thought necessary.

Diseases of Class XV, by occupational groups, new admissions, 1939

Occupational group	Psychoneuroses ... Order of frequency	Rate per 100,000	Constitutional psychopathic ... Order of frequency	Rate per 100,000	... Order of frequency	Rate per 100,000	Dementia praecox Order of frequency	Rate per 100,000	... Order of frequency	Rate per 100,000	... Order of frequency	Rate per 100,000	... Order of frequency	Rate per 100,000	Miscellaneous Order of frequency	Rate per 100,000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

RESPIRATORY SYSTEM

There were 318 original admissions and 20,719 sick days for diseases in this class during the year 1939, accounting for 0.52 percent of all admissions and 1.72 percent of total sick days.

In addition, there were 54 admissions for complications of other diseases or conditions, 21 admissions reported as existing prior to enlistment, 74 readmissions, and 47 cases remaining from the previous year.

Four of the diagnoses in Class XVIII (chronic bronchitis, asthma, acute fibrinous pleurisy, and sero-fibrinous pleurisy) caused 75 percent of class admissions and 68 percent of class sick days.

The common acute infectious diseases of the respiratory tract, colds, acute bronchitis, etc., as well as pneumonia, are classified as "Communicable diseases transmissible by oral and nasal discharges," and certain other diseases that might be thought of as diseases of the respiratory system, are accounted for in Class V, "Diseases of ear, nose, and throat." Class XVIII, therefore, does not account for a great number of admissions to the sick list.

Diseases in this class causing more than 10 admissions, together with a total for those diseases in the class causing less than 10 admissions, are listed in the following table:

Diseases of Class XVIII, admissions and sick days, 1939

Disease	New admissions	Admission rate per 100,000	Sick days per case
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Total for diseases in the class causing less than 10 admissions	[illegible]	[illegible]	[illegible]
Total for entire class	[illegible]	[illegible]	[illegible]

Diseases of Class XVIII, with complications, 1939

Disease	Number cases admitted	Complication	Cases	Percent
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Diseases of Class XVIII, classified personnel, admissions by age group, 1939

Age group	Officers, Navy and Marine: Number in group	Officers: New admissions	Officers: Rate per 1,000	Enlisted men, Navy: Number in group	Enlisted Navy: New admissions	Enlisted Navy: Rate per 1,000	Enlisted men, Marine: Number in group	Enlisted Marine: New admissions	Enlisted Marine: Rate per 1,000
16 to 19	0	0	0	11,810	26	2.34	3,[illegible]	3	0.78
20 to 24	1,120	1	0.89	50,120	[illegible]	1.57	[illegible]	21	2.7[illegible]
25 to 29	3,600	15	4.17	[illegible]	30	1.12	2,333	6	[illegible]
30 to 34	[illegible]	3	1.3[illegible]	14,[illegible]	37	1.51	1,880	4	2.1[illegible]
35 to 39	[illegible]	6	2.6[illegible]	11,378	22	1.[illegible]	1,[illegible]	3	2.4[illegible]
40 to 44	1,[illegible]	6	3.1[illegible]	2,[illegible]	8	2.74	[illegible]	3	3.7[illegible]
45 to 49	1,4[illegible]	6	4.0[illegible]	620	[illegible]	[illegible]	281	2	7.[illegible]
50 to 54	1,0[illegible]	2	1.9[illegible]	182	1	[illegible]	[illegible]	0	0
55 to 59	540	0	0	[illegible]	0	0	[illegible]	1	43.48
60 to 64	12[illegible]	1	8.40	4	0	0	3	0	0
65 and over	2	0	0	0	1	0	0	0	0
All ages	13,[illegible]	38	2.84	114,487	[illegible]	2.03	18,[illegible]	44	2.3[illegible]

CIRCULATORY SYSTEM.

Diseases in this class were responsible for 562 original admissions and 40,522 sick days, or 0.92 percent of all admissions and 3.37 percent of total sick days. The admission rate was 376 per 100,000, as compared with 326, the admission rate in 1938, and 356, the median for the 9 preceding years.

Five of the diagnoses in the class (arterial hypertension; varicose veins; thrombosis, coronary artery; phlebitis; and chronic myocarditis) caused 61 percent of class admissions and 63 percent of class sick days.

In addition to the 562 original admissions shown in the table below, there were 51 admissions covering cases reported as complications of other diseases and conditions, 116 readmissions, 85 for diseases reported as existing prior to enlistment, and 107 cases remaining from the previous year.

Thirty-five of the 105 persons invalided from the service on account of diseases in this class incurred the disability prior to entering the service.

Diseases for which 10 or more admissions were recorded during the year and a total for those diseases in the class causing less than 10 admissions are shown in the following table:

Diseases of Class II, admissions and sick days, 1939

Disease	New admissions	Admission rate per 100,000	Sick days per case
Hypertension, arterial	162	108	44.7
Varicose veins	79	53	28.0
Thrombosis, coronary artery	38	25	74.7
Phlebitis	32	21	42.5
Myocarditis, chronic	30	20	60.4
Cardiac arrhythmia, premature contractions	23	15	40.3
Syncope	21	14	20.6
[illegible]	17	11	8.6
Arteriosclerosis, general	16	11	49.1
Tachycardia	16	11	31.0
Coronary heart disease, arteriosclerotic	13	9	56.3
Angioneurotic edema	12	8	19.3
Cardiac disorder, functional	12	8	30.1
Cardiac arrhythmia, paroxysmal tachycardia	10	7	28.3
Total for diseases in the class causing less than 10 admissions	81	54	57.1
Total for entire class	562	376	44.0

UNITED STATES NAVY DEPARTMENT
BUREAU OF MEDICINE AND SURGERY

ANNUAL REPORT OF THE SURGEON GENERAL, U.S. NAVY

CHIEF OF THE BUREAU OF MEDICINE AND SURGERY

TO THE SECRETARY OF THE NAVY

CONCERNING

STATISTICS OF DISEASES AND INJURIES IN THE UNITED STATES NAVY

FOR THE CALENDAR YEAR

1941

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON · 1944

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and reclaiming unit. The decrease in the concentration of dust has been of primary importance from the health standpoint. Other advantages are a decrease in operating cost because of ability to reclaim some 75 percent of the sand and water, decrease in time needed for cleaning castings, better quality of the finished job, and elimination of pickling process to get rid of last traces of sand.

Navy Yard, New York, N. Y.—Experience indicates that individuals of the type to apply for employment through the Labor Board have an incidence of active pulmonary tuberculosis of about 2 percent. In most cases, the disease cannot be detected by ordinary physical examination. Consideration is at present being given to the practicability of including a chest x-ray as part of the preemployment examination.

The urgent demand for personnel, particularly in some of the skilled trades, has led to a lowering of the physical standards set forth by the Civil Service Commission in a number of occupational classifications. Up to the present time, there has been no evidence that this lowering of physical requirements has been responsible for increased illness or accident rates.

In accordance with instructions contained in Secretary of the Navy letter dated 25 October 1941 periodic physical examinations have been given to employees engaged in certain work hazardous to themselves or others. In addition to these periodic examinations, it has been considered advisable to perform periodic chest x-ray examinations on tool-grinders and on workers handling fibre glass. The use of this latter material has recently been introduced for insulating purposes, and since little is known of the effects of fibre glass dust upon the lungs, it seems desirable to keep a close watch of those employees who handle this material. In view of the increased scope of the periodic examinations, expansion of the facilities for performing these examinations has been necessary. The establishment of an industrial health office has been the first step to meet the increased requirements of the industrial program. It was felt that improved x-ray equipment suitable for taking chest x-ray films would facilitate and expedite performance of the required periodic examinations. Purchase of such equipment has been approved.

In July 1941, a Reserve officer with a wide experience in industrial health work was assigned to duty at the yard. Shortly thereafter, a medical officer from the Regular Navy who had undergone a course of training in industrial hygiene, was ordered to duty at the yard. After a short period of indoctrination, these two officers were designated as Industrial Health Officer and Assistant Industrial Health Officer, respectively.

A comprehensive industrial health program has been put into operation. The following activities have already been accomplished:

(a) Survey of lighting in several shops with recommendations for improvement.

(b) Study of the efficiency of spray painting booths, with recommendations.

(c) Study of ventilation in the temporary foundry, with recommendations.

(d) A study of illness (mercury poisoning) among painters working with antifouling plastic paint. As a result of this study, effective control measures have been put into effect.

(e) An investigation of nonstandard cleaning and degreasing agents used in the yard. As a result of the findings an order was issued prohibiting the use of unapproved cleaning agents in the yard.

(f) Compilation of a list of materials used in the yard which may offer potential health hazards. This list includes all solvents, such as benzol and carbon tetrachloride; all dust-producing materials, such as asbestos, sand, and fibre glass; and all toxic metals, such as lead and magnesium. Tabulations have been made showing which shops are using each substance and a paralleled analysis showing what materials are used in each shop. These tabulations are to be used as a basis for a comprehensive program of occupational disease prevention.

(g) A campaign of health education was instituted in an effort to reduce lost time due to nonindustrial illness among civilian employees. Posters illustrating the spread of respiratory infections have been placed on all bulletin boards in the yard. Plans have been formulated for distributing educational material on the subject of colds, tuberculosis, and nutrition.

(h) Preemployment chest x-ray survey. During the latter part of 1941, plans were completed for taking chest x-ray films on a sample of 1,000 consecutive male applicants for employment to ascertain whether any significant number of cases of active pulmonary tuberculosis will be found among men seeking employment at the yard.

(i) Space on the ground floor of Building No. 200, at the present time occupied by the safety engineer, has been allocated for use as industrial health office and laboratory.

Norfolk Navy Yard, Portsmouth, Va.—Although some attention has been directed to industrial hygiene at this yard for several years, it was not until the latter part of 1941 that a medical officer was assigned to this phase of medical department activities. The safety officer and the medical department have cooperated in an effort to detect hazards, and recommend measures to obviate them or make them less hazardous.

Preemployment physical examinations were conducted by the medical section of the Labor Board. An attempt is being made to conduct recheck examinations as recommended by the Navy Department, especially on those engaged in occupations involving hazardous exposures. Complete blood counts were obtained c[illegible]um handlers, basophilic aggregation tests on welders, cutter.

burners, and painters, and x-ray examinations of the chest are made on sandblasters.

The silica hazard in the foundry was reduced somewhat by the substitution of steel grit for sand in two modern blasting units. One old type sandblasting unit using sand is still in operation. Plans to replace this unit have been made and it is anticipated that this will be accomplished as soon as practicable. To minimize the hazard presented by sandblasting operations, approved personal protection equipment is provided.

There has been some time loss from metal fume fever particularly among those working around welding and burning operations on new construction and repair jobs. In many cases the men are exposed unnecessarily to fumes due to reluctance on the part of leading men to take the time to secure and set up blowers in compartments where they are needed. It very frequently happens that attacks of metal fume fever develop among others working in the compartment than in welders or burners. Also cases develop among those working in a compartment when the bulkhead is being heated on the opposite side. This necessitates adequate ventilation in both compartments. An approved metal fume respirator that is so constructed that it can be worn under a welder's shield is being recommended for use by those exposed to metal fumes, and it is anticipated that the use of these respirators will reduce the time loss and increase production and efficiency.

There continues to occur an unnecessary number of cases of ophthalmia due to actinic rays from the welding arc. This is due to inexperience among many of the welders' helpers, carelessness on the part of those that may be working near welding operations, and failure of the welder in many instances to shield his work properly.

Goggles are provided for and generally used by those engaged in chipping and grinding. In spite of this an average of five foreign bodies in the eye occurs each day. These are most frequently due, however, to causes other than grinding and chipping. Occasionally a foreign body in the eye case is due to improperly fitting goggles as well as goggles worn on the forehead instead of over the eyes, and many of them happen while the worker is walking about in the yard to and from jobs and to and from work.

The campaign for the wearing of safety shoes has not been successful, and there continues to be an undue number of toe injuries, particularly among riggers.

Puget Sound Navy Yard, Bremerton, Wash.—A medical officer reported 11 August 1941 as the industrial medical officer for this navy yard. He is doing excellent work, and has offered many suggestions that have been instituted in aiding the health and hygiene of the industrial yard.

The list of technical equipment to establish an industrial health laboratory has been approved.

The industrial health officer is working in close cooperation with the injury officer and the leading-men of the various shops projects. Some very interesting and informative data ha[illegible]

been accumulated regarding injuries to yard employees and nonoccupational lost time.

The enlarged industrial health program was explained to the heads of the departments in the yard and to the masters of the various shops. The new program was received with enthusiasm and assured full cooperation. Many contacts with quartermen, leadingmen and individual workers have been established by the industrial medical officer during his frequent visits to the shops. A survey was made of all the shops and activities, and a chart prepared showing the location and nature of the possible health hazards.

Space for an industrial hygiene laboratory has been allotted in the chemical laboratory building and technical equipment has been requested. With the establishment of this laboratory, facilities will be available for investigation of industrial health hazards in this naval district.

A total of 2,276 eye injuries were treated at the dispensary during 1941 which indicates that the present eye protection is not satisfactory. The fact that eye injuries totaled 25.5 percent of all cases, but accounted for only 3.2 percent of the lost-time accidents indicates that there were few complications following the injuries.

The industrial medical officer has been working in cooperation with the safety engineer to determine the basic causes of the high frequency of certain types of injuries in the various trades. Meetings of supervisors in classes of 40 to 50 have been initiated. At these meetings emphasis is placed on the responsibility of the supervisors in guarding the safety and health of their men. Numerous problems and comments about procedures, policies, equipment and conditions were uncovered in the discussions following these meetings.

There were 10,401 sick leave applications during the year requesting a total of 46,451 sick days. Since a few employees do not have sufficient accumulated sick leave to cover their entire illness or injury, some take annual leave instead of sick leave, and some of the sick leave applications are not approved, 46,451 is not the total days absent from work due to nonoccupational illness. The following summary of a 3-year period is submitted for comparison:

	1939	1940	1941
Number of sick leave applications	2,708	6,174	10,401
Number of sick days requested and approved	16,927	28,594	46,451
Average days requested per application	6.25	4.63	4.46
Average number of applications each month per 1,000 employees	46.1	66.6	62.1
Average number of sick days requested each month per 1,000 employees	282	318	277

The lower average days of illness per case in 1940 and 1941 is apparently due to a great increase in one and two-day absences.

Both the frequency of applications and the nur[illegible] of sick days requested show an expected seasonal variation

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INDUSTRIAL HYGIENE AND THE NAVY IN NATIONAL DEFENSE

ERNEST W. BROWN, M.D.
Captain, Medical Corps, United States Navy
NEW YORK

One of the most important concerns of the Medical Department of the United States Navy today is industrial hygiene, especially in navy yard practice. This is a situation of ever increasing moment in view of the present era of enormous expansion in naval construction, unparalleled in the history of the United States. This is bringing about a vast increase in the industrial force of the navy yards, and in all probability new problems in industrial hygiene will emerge incident to new materials and processes.

It should be remembered in this connection that the policy of the Navy Department is to allot new naval construction on an equal basis to government and commercial yards. It follows that the commercial establishments are also undergoing rapid development, with an enormous rise in industrial personnel. They will therefore be confronted with problems of industrial hygiene similar to many of those arising in navy yards.

Industrial hygiene is a field which is now undergoing rapid development. This appears to be due to certain significant trends, the most important of which has been the recent setting up of many industrial hygiene units in state or city departments of health through funds released by the passage of the Social Security Act. These trends, in fact, particularly that just mentioned, reflect a definite renaissance of industrial hygiene as a phase of public health in the United States.

This movement is receiving increasing recognition in naval industrial circles, and industrial hygiene is now listed as a specialty of the naval medical officer along with other specialties outside the purely clinical fields, such as aviation medicine, submarine medicine and chemical warfare medicine.

Those just mentioned, however, are concerned primarily with naval personnel. Industrial hygiene, on the other hand, is largely occupied with federal industrial personnel. It therefore follows that the status of the senior medical officer of a major navy yard in relation to the industrial

Presented at the Fifth Annual Meeting of the Air Hygiene Foundation of America, Inc., Pittsburgh, Nov. 13, 1940.

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department is analogous in many respects to that of the medical director of a large commercial industrial plant. The object of this paper is to present an outline of the administration of industrial hygiene in navy yards, which are the chief industrial units of the Navy.

Mention should be made in this connection of the Subcommittee on Industrial Medicine of the Health and Medical Committee of the National Defense Council. The Surgeon General of the Navy is a member of the latter committee and is represented by two liaison naval medical officers in conjunction with the Subcommittee on Industrial Medicine. Important recommendations pertinent to the Navy and industrial health will result, and many of them undoubtedly will be put into effect.

The term industrial hygiene as applied in the present discussion is used in the specific sense of the prevention and control of occupational disease. The fact may be of interest that the first compensation law for occupational diseases in this country was one passed in 1908 by Congress for United States civil service employees. Compensation laws for industrial diseases have lagged far behind legislation covering accidents. Only sixteen states of the Union provided compensation for one or more occupational diseases up to the year 1937, although all but two provided legislation for accidental injuries.

INDUSTRIAL ORGANIZATION OF NAVY YARDS

The mission of a navy yard is primarily the construction, maintenance and repair of naval vessels. The central administration of navy yards and, in fact, of all industrial shore stations of the Navy is vested in the Assistant Secretary of the Navy, in whose office is the Shore Establishments Division of the Navy Department.

There are eleven navy yards, located as follows: Portsmouth, N. H.; Boston; New York; Philadelphia; Washington, D. C.; Norfolk, Va.; Charleston, S. C.; Mare Island, Calif.; Puget Sound, Wash.; Territory of Pearl Harbor, Territory of Hawaii; and Cavite, Philippine Islands.

In addition, mention should be made of the following specialized industrial plants: the plants for the building of submarines at Portsmouth, N. H., and Mare Island, Calif.; the Naval Gun Factory at the Navy Yard, Washington, D. C., for the production of high caliber naval guns, torpedo tubes and accessories; the torpedo factories at Newport, R. I., and Alexandria, Va., for the manufacture of torpedoes; the powder plant at Indian Head, Md., for the production of Navy smokeless powder; the aircraft factory at Philadelphia for experimental air craft construction and repair; the naval armor plate plant at Charleston, W. Va., and the Naval Clothing Factory at Brooklyn.

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Organization of the New York Navy Yard.—The New York Navy Yard may be taken as typical of a major yard. Its organization falls under two departments, i. e., the industrial department, headed by a naval captain of the engineering branch, and an operations or military department, under the direction of a naval line captain. As a conservative estimate it may be stated that 90 per cent of the activities of a navy yard are industrial.

Under the industrial manager there are at present twenty-three shops of different types, with a force per shop varying from 30 to 3,200 men. The total number of civil employees of this yard is now approximately 17,000. This is rapidly rising and, it is estimated, will exceed 20,000 in 1941.

EXTENT OF THE CIVILIAN INDUSTRIAL FORCE OF THE NAVY

The combined industrial force of all navy yards is now approximately 130,000. In view of the pending program of naval construction it is estimated that this number will reach 150,000 in 1941. If made inclusive of all shore stations it will probably be close to 180,000.

In addition to the industrial force of navy yards, one must consider the employee volume in the commercial naval ship-building plants, such as the Newport News and Dry Dock Company, the New York Shipbuilding Corporation at Camden, N. J., and the Bethlehem concern at Quincy, Mass., which now employ from 12,000 to 15,000 men each. It is a conservative estimate that the combined industrial personnel of all such plants on both the east and the west coast will reach a peak of over 100,000.

ORGANIZATION OF THE MEDICAL DEPARTMENT OF A NAVY YARD

The medical staff of the New York Yard consists of ten medical officers, five dental officers, one nurse, forty-five enlisted men and two civilian clerks. The chief activities with reference to industrial personnel may be summarized as follows:

(*a*) Preemployment physical examinations. All applicants for federal jobs are examined physically, although the standards for acceptance vary to some extent for different occupations.

(*b*) Periodic physical examinations. These, of course, are conducted with the object of medical supervision of certain groups of employees exposed to definite potential health hazards, such as foundrymen and spray painters.

(*c*) Physical examination of federal employees for retirement. This is for evaluation of the degree of disability and opinion as to disposition when total disability is alleged.

(*d*) Diagnosis, treatment and disposition of industrial injuries and occupational diseases.

(*e*) Administration of compensation cases. (*f*) Industrial hygiene and plant sanitation.

THE INDUSTRIAL MEDICAL OFFICER

An officer of the medical staff of the navy yard is specifically detailed for industrial hygiene administration subject to the direction of the senior medical officer. Figure 1 outlines the scope of his activities.

(*a*) Advice to the safety engineer. The adequate practice of industrial hygiene in navy yards, as in civil industry, is dependent on the close and efficient correlation of the work of the safety engineer and that of the industrial medical officer. It is essential to obtain a grasp of the functions of both officers in order properly to visualize industrial hygiene administration.

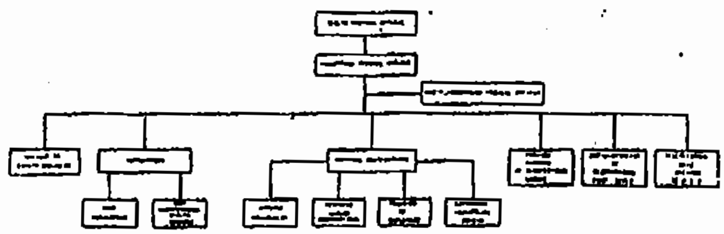

Fig. 1.—Organization for administration of industrial hygiene in navy yards.

(*b*) Inspection. The industrial medical officer is responsible for the general supervision of plant sanitation, i. e., ventilation, illumination, water supply, general cleanliness and adequacy and condition of sanitary facilities. He also conducts shop inspections for occupational health hazards and measures for their control. He cannot expect to evaluate working conditions and thereby detect occupational health hazards early unless he makes periodic inspections through the plant. In this way he can observe the adequacy of existing measures against specific hazards and decide whether such methods are being properly utilized. These inspections also have a psychologic value, in that they create greater respect for the medical service in the minds of the employees.

(*c*) Supervision of special physical examinations. This includes handling of preemployment cases when the applicant reports previous exposure to potential industrial health hazards, such as lead fumes or foundry dust; periodic examinations of groups exposed to such potential occupational hazards, e. g., spray painters and sandblasters; examination

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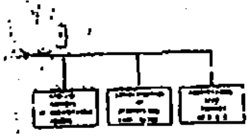

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of persons referred for transfer to other shops where there is a question of occupational disability, and clinical studies for a decision as to industrial origin of obscure disabilities. (*d*) Medical surveys of occupational groups.—This will be discussed later. (*e*) Administration of the medical aspects of claims for compensation for occupational disease pending before the United States Employees' Compensation Commission. (*f*) Supervision of preparation of accident and occupational disease reports for the Navy Department.

THE SAFETY ENGINEER

A civilian safety engineer is stationed at the Navy Department as the adviser to the head of the Shore Establishments Division. A naval officer is assigned to each navy yard as the safety engineer.

1. Accident and Unsafe Practice Control.—Safety engineering is one of the divisions of the navy yard organizations. The safety engineer conducts an investigation of all lost time accidents with a view to fixing the cause and advising measures to prevent their recurrence. The basic features of approach to the safety problem in navy yards are provision of safety devices, such as mechanical guarding, and the safety education of workmen and their supervisors.

Another important aspect is the competitive approach, which has proved effective in stimulating interest in accident prevention. The Navy Department publishes the comparative safety scores of all navy yards monthly.

Figure 2 emphasizes the advance made by the Navy Department in accident reduction, beginning with an intensive safety campaign in navy yards in 1926. The period covered is from 1926 to 1937 inclusive. The accident rate was lowered from 20 to practically 10 per year in a twelve year period; the severity rate reduced from 2.2 per year to 0.5. On the other hand, it will be noted that the total man hours worked during the period increased to 115 million from 65 million per year, the average number of employees rising from approximately 30,000 to 66,000.

2. Occupational Health Control.—The control of occupational disease in navy yards naturally lies within the sphere of both the safety engineer and the industrial medical officer. Although the safety engineer is administratively charged with this task, the medical officer is actually coordinate with him in this phase.

As a matter of fact, the medical officer is the key man in the prevention of industrial disease in navy yards, in that he usually discovers its existence. The diagnosis having been made, the occupational history and the preemployment examination record are carefully reviewed in order to reach a decision, if possible, whether the hazard can be traced

to present or past employment. If it is ascribed to or aggravated by environmental conditions, the medical officer confers with the safety engineer, and an industrial hygiene survey is usually recommended to the commandant.

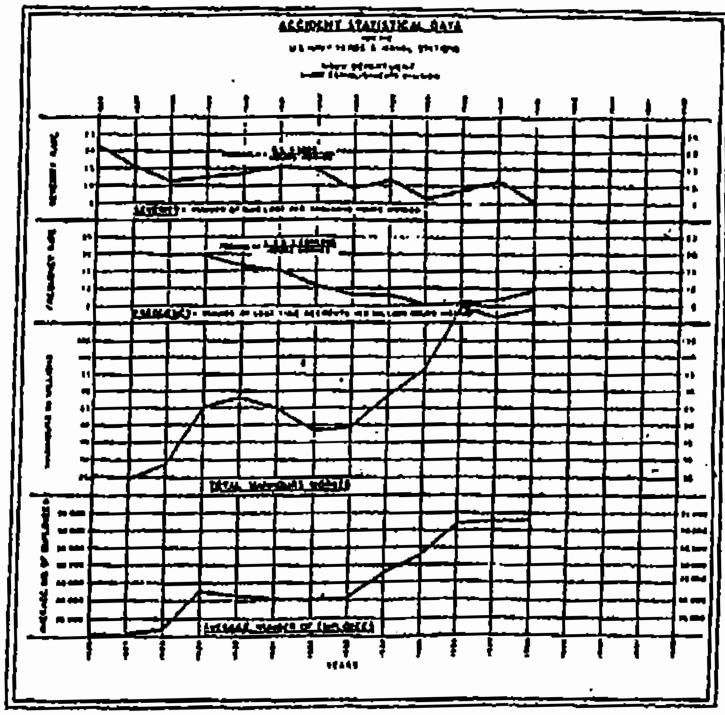

Fig. 2.—Statistical data on accidents for the United States navy yards and naval stations.

THE INDUSTRIAL HYGIENE SURVEY

An industrial hygiene survey is of course a combined medical and engineering task.

1. The Medical Survey.—This consists of a complete clinical study, with detailed occupational histories of all exposed personnel as a case-finding procedure under the supervision of the industrial medical officer.

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Although not directly responsible beyond the medical survey, it is important that the medical officer have a reasonable grasp of the entire problem so that he will be in a position to utilize all data that have any bearing on the interpretation of his medical findings. In addition, he may act in an advisory capacity to the safety engineer with respect to certain technical phases in the planning and conduct of the engineering aspects of the survey.

2. The Engineering Survey.—The engineering phases of an industrial hygiene survey in a navy yard fall, naturally, under the direction of the safety engineer. As in a commercial industry, this embraces essentially a complete story of the occupational duties, the physical conditions of work, and the materials, processes and equipment of the individual shop; in other words, the environmental conditions.

Laboratory facilities: No facilities are provided for technical studies in the navy yard organization, and there is no central laboratory unit in Washington which could supply industrial hygienists for field studies. This is an urgent need, and recommendations have recently been made to the end of setting up such an agency.

The Navy Department has been most fortunate in the past in securing the services of the Division of Industrial Hygiene of the United States Public Health Service to conduct such technical studies, much in the same way that industries in the states utilize the facilities of state bureaus of industrial hygiene.

The safety engineer formulates the control program of the health hazard on the basis of the data obtained in the survey. After all, once the cause is disclosed, prevention of occupational disease is largely an engineering problem.

THE REPORTING OF INDUSTRIAL ACCIDENTS AND ILLNESS

An important advance in accident prevention by the Navy was initiated on July 1, 1940, when the Secretary directed that a report of each accident and illness, both "lost time" and "no lost time," occurring among civil personnel of navy shore establishments be made to the Bureau of Medicine and Surgery. The report of each accident is submitted on a form, known as form F-C (fig. 3). This presents the diagnosis of the injury and the essential details as to the cause. Punch cards are made up from these records for mechanical tabulating and indexing through a sorting machine. This provides facilities for the statistical analysis of these accidents and diseases, and the data obtained promise to be a far reaching contribution to the subject of accident control. Prior to use of this system a crude system of accident reporting to the department was in effect, but it was not adapted to statistical analysis.

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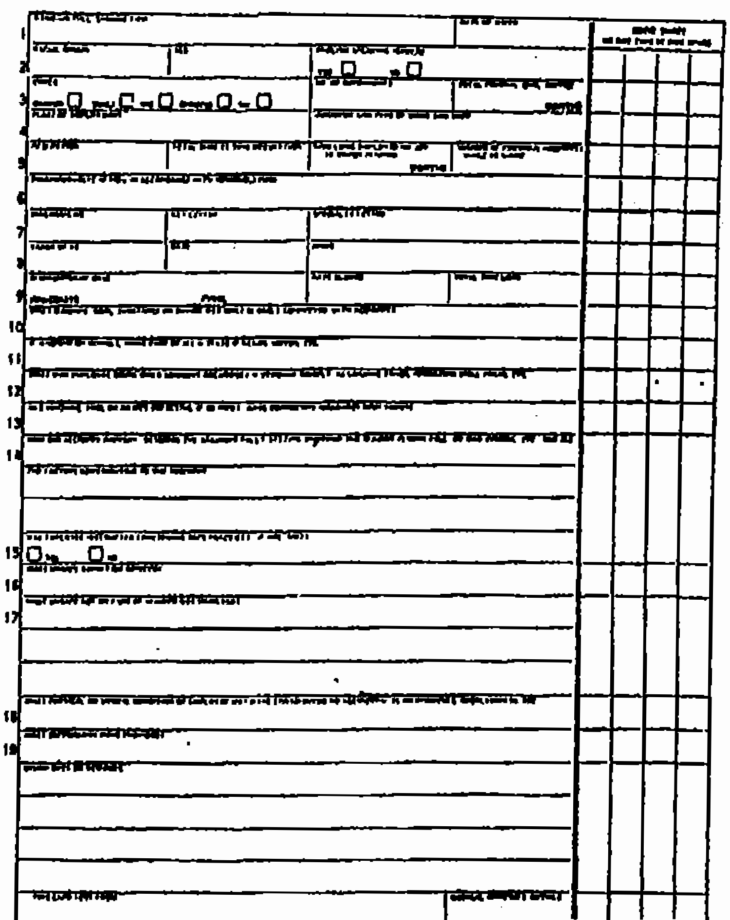

TO BUREAU OF MEDICINE AND SURGERY

Fig. 3.—Form for report of industrial disability.

SURGERY

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OCCUPATIONAL HEALTH HAZARDS IN NAVY YARDS

The chief potential occupational health hazards in navy yards will now be considered as indicated in the accompanying table. The data are based chiefly on reports to the United States Employees' Compensation Commission over a series of years. It hardly requires emphasis that industrial medical officers must be constantly on the alert for new health hazards.

Occupational Health Hazards in United States Navy Yards

1. Dust Diseases
   (a) Silicosis: foundry workers and sandblasters.
   (b) Asbestosis: makers of pipe insulating covers
2. Diseases Due to Lead and Lead Compounds
   (a) Spray lead painters
   (b) Brush lead painters
   (c) Lead putty workers
   (d) Oxyacetylene welders: cutting and scrapping of ships
   (e) Handlers of molten lead: preparation of Babbitt metal and lead coating of metals
   (f) Handlers of lead oxide used in pulverized form as a detonator in naval munitions
3. Diseases Due to Volatile Organic Solvents
   (a) Lacquer spray painting
   (b) Degreasing of machinery: benzene, toluene, xylene, trichlorethylene. Higher alcohols, etc.
4. Diseases Due to Roentgen Rays and Radium
5. Diseases Due to Welding
   (a) Nitrous gases
   (b) Metallic oxides, of potentially toxic nature: manganese, lead, fluorides, [illegible], etc.
   (c) Zinc fume fever
   (d) Eye hazards: actinic ophthalmia chiefly
6. Chromate Poisoning: electric platers
7. Diseases Due to Ingestion of Radium: painters of luminous dials of instruments
8. Injuries from Nitro Explosives: workers in high explosives, such as T. N. T. and tetryl (tetranitromethylaniline)
9. Diseases Due to Metallic Dust
   (a) Excessive pulmonary fibrosis: grinders, buffers and polishers; carborundum, alundum, etc.
10. Dermatoses: Machine operators from contact with cutting and soluble oils
11. Diseases Due to Excessive Heat: heat cramps, heat exhaustion and heat stroke
12. Caisson Disease: diving operations
13. Functional Disturbances
   (a) Anoxemia: from entering confined spaces
   (b) Phosgene poisoning: from carbon tetrachloride used to extinguish fires in confined spaces
   (c) Carbon monoxide poisoning: incident to all fires in confined spaces

1. Dust Diseases.—(*a*) Silicosis: Important units of all navy yards are iron, steel and brass foundries. The dust control problem is a major concern in these plants as in civil industry.

One of the difficulties met with in combating the foundry dust problem in navy yards is the fact that silica (silicon dioxide) dust is not particularly irritating or obnoxious in concentrations which may ultimately lead to pulmonary damage. As a result there is a tendency to an indifference on the part of the workers and even of the supervisors and executives which must be overcome in order to accomplish effective and permanent dust control. Another reason for this attitude is the long period necessary for silicosis to develop in foundry workers exposed to only moderate concentrations of dust, such as molders.

A medical survey of the foundries of the Navy Yard, Washington, D. C., was conducted by me in 1939. Of 525 men subjected to roentgen examination, approximately 60 per cent had a record of ten years or over and 36 per cent a record of twenty years or over of total foundry employment. Silicosis was found in 12, or 2.4 per cent of the total—in all of them in stage 1 or 2; these data led to recommendations for improved methods of dust control.

Industrial hygiene surveys in foundries other than the Washington Navy Yard have not as yet been carried out but would in all probability disclose a certain incidence of silicosis, even if not of the disabling type. The medical control of silicosis in the naval establishment consists of roentgen examination of the chest before employment and an annual roentgenogram of every man exposed to the higher silica dust concentrations, such as sandblasters and shake-out men.

(*b*) Asbestosis: This is a potential occupation disease hazard due to inhalation of asbestos dust among workers engaged in the manufacture of asbestos insulating covers for flanges, valves and high temperature steam turbines.

I recently conducted a medical survey of the workers of the pipe-insulating shop of the New York Navy Yard, inclusive of roentgen studies. The maximum working period of exposure was seventeen years. No cases of asbestosis were found. Similar findings have been reported from two other yards, but the study should be extended to all men in this trade.

Medical control consists of taking a roentgenogram of the lungs annually. The material is moistened, and localized exhaust ventilation is installed over the work area. A respirator is worn during the dustiest aspect of the process.

2. *Diseases Due to Lead and Lead Compounds.*—Lead poisoning has become comparatively infrequent in recent years both among industrial and among service naval personnel. This is apparently due partly to changes in materials and methods and partly to improved measures of control. Zinc and titanium paints have largely replaced leaded material for ship interiors. Red lead paint is still in use as the priming coat on hull exteriors, but the finishing coats contain either no lead or a greatly reduced proportion. All painters regularly handling lead-containing paint are examined semiannually for evidences of lead absorption.

3. *Diseases Due to Volatile Organic Solvents.*—Lacquer spray painting is done on an extensive scale in navy yards and therefore demands rigid medical supervision. Another important application is in degreasing measures. All spray lacquer personnel are subject to semiannual physical examination.

4. *Diseases Due to Roentgen and Radium Hazards.*—Radium and roentgen rays are continually utilized for the detection of flaws in castings

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and pipe-welded joints for high pressure steam installations. Radium has an advantage in the small size of the equipment in that it is adapted to tests in the confined machinery spaces of ships.

The question of protection from irradiation of the operating and other personnel working in the vicinity of the apparatus has received thorough study, the practice of the Bureau of Standards being generally followed. Complete blood counts of all technicians are conducted quarterly, and special preemployment examinations are prescribed.

Another potential hazard of radium is that of ingestion incident to radium painting of luminous dials, especially for fire control instruments and aircraft. The control measures advised by the Public Health Service are generally in force plus certain local regulations.

5. Diseases Due to Welding.—The hygienic supervision of welders is another outstanding feature of medical responsibility. Approximately 2,500 welders were on the rolls of the combined shore establishments as of Jan. 1, 1940, including 653 at New York. This number has progressively increased and will continue to rise.

The immense volume of work in confined spaces is characteristic of naval welding. A battleship of 35,000 tons displacement under construction contains approximately 500 compartments in which electric welding is mandatory; certain of these spaces are extremely small and force the welder to work in very cramped positions. These conditions complicate the question of effective preventive control of the hazards.

The chief hazards which have to be considered at present are "nitrous fume" poisoning, zinc fume fever, as it is popularly termed, and actinic opthalmia from ultraviolet irradiation of the welding arc. "Nitrous fume" poisoning, while comparatively rare, is a serious condition. No emphasis need be placed on the fact that these injuries would be still further reduced in number if the control measures provided were properly utilized.

It may be of interest to note that in 392 cases of actinic ophthalmia reported at the New York yard in the first ten months of 1940, only 30 per cent of the patients were welders, apprentice welders, helper welders and tack welders; the remaining 70 per cent were men exposed in spaces adjacent to the welding arc or assisting in welding operations but not utilizing available protective goggles.

Chronic poisoning among naval welders from manganese, fluorides or silicon, which might be ascribed to inhalation of these metallic or mineral oxides in the welding fumes originating in the rod coatings, has not been reported. The possibility of such poisoning, of course, cannot be denied.

Limitation of space prevents mention of additional occupational health hazards.

ANNUAL EXAMINATIONS OF CRANE OPERATORS, ENGINE MEN (HOISTING AND PORTABLE) AND LOCOMOTIVE ENGINEERS

These classes of workers are physically examined annually, with special emphasis on blood pressure, hearing and vision. In view of the nature of their duties, physical failure, such as sudden collapse, might involve critical injury to themselves and others and, in addition, damage to material. If corrective measures are impracticable the worker is retired or transferred to some suitable type of employment. A crane operator, for instance, presenting marked hypertension would be referred to his private physician and transferred to other duties.

LOSS OF TIME FROM INDUSTRIAL VERSUS NONINDUSTRIAL DISABILITIES

In a limited study of 116 industrial companies in various parts of the United States conducted by the American College of Surgeons a few years ago, it was found that the loss of time from nonindustrial types of illness was approximately fifteen times that industrially connected. In my capacity as senior medical officer of the Washington Navy Yard I made the following observations for the calendar year 1938: total industrial force, 7,000; average number of days lost from industrial accidents 0.14, and average number of days lost from nonindustrial illness or accident, 5.20. The time lost from nonindustrial disability was therefore thirty-seven times that lost from industrial causes. A similar study made by me at the New York Navy Yard for 1939 revealed that the time lost from industrial causes was roughly four times that from nonindustrial causes. The possible factors in the difference between the two yards have not been analyzed.

Disparities of the same general order have been reported in recent statistical studies by certain large commercial industries and reflect an enormous economic loss. Much of this nonindustrial illness is preventable. It is believed that in the naval establishments this wastage due to preventable illness can be greatly reduced if the problem is attacked by an annual physical examination of all employees, men requiring corrective treatment being referred to their private physicians or to other agencies. This would require a heavy increase in medical staffs, but it would be a profitable investment by naval industry in the saving of man power for national defense. It is a question worthy of being explored.

EXHIBIT H

U. S. Navy Department • U. S. Maritime Commission

573-1-6

Minimum Requirements

FOR

SAFETY AND INDUSTRIAL HEALTH

IN

CONTRACT SHIPYARDS

1943

File 2/14/44

Approved
U. S. Navy
Jan. 28, 1943

Approved
U. S. Maritime Commission
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DEFENDENT'S
EXHIBIT
Buffalo Pumps
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U. S. NAVY DEPARTMENT
WASHINGTON, D. C.

U. S. MARITIME COMMISSION
WASHINGTON, D. C.

To All Contractors Constructing Ships for United States Navy—United States Maritime Commission:

As a result of the national conference on safety and health in shipyards holding contracts with the United States Navy and Maritime Commission, conducted under the auspices of these agencies in Chicago December 7 and 8, 1942, a unanimous agreement was reached upon the minimum standards which have now been approved by the Navy Department and United States Maritime Commission and which should be put into effect in shipyards holding contracts with the two agencies.

These standards represent a specialized study based upon a fact-finding survey on all coasts by experts in that field. They have received the unanimous concurrence of the representatives of the medical and safety departments and of labor-management committees from shipyards on all coasts.

The necessity for conserving manpower and promoting the physical welfare, health, and safety of what shortly will amount to one million workers in shipyards requires that careful observance of standards for the prevention of accidents and protection of health be accorded. Aside from the weight which must be given humanitarian considerations, it is simply good common sense that as much care and attention be given to protecting the human factors in the war production program as is given machines.

Under the administrative direction of the Maritime Commission, safety and industrial health consultants will be made available in all regions wherein shipyards holding contracts with the Navy and the Commission are located.

Each contractor is hereby given notice that the Navy Department and the Maritime Commission will expect full and complete compliance with the minimum standards which bear the approval of the Navy Department and the Maritime Commission, and each is requested to give full cooperation to the consultants on health and safety who will be charged with the coordination and supervision of the safety and health programs of the two agencies.

The cumulative restriction of manpower makes speedy attention and comprehensive action in respect to the subject matter hereof of vital importance.

Frank Knox

FRANK KNOX, *Secretary of the Navy.*

E. S. Land

E. S. LAND, *Chairman,*
U. S. Maritime Commission.

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UNITED STATES NAVY—MARITIME COMMISSION

MINIMUM REQUIREMENTS

FOR

SAFETY AND INDUSTRIAL HEALTH IN CONTRACT SHIPYARDS

S and H-1. Introduction.

1.1 The standards for industrial health and safety as presented in this manual cover only minimum requirements. It is not to be assumed that compliance with these minimum standards is insurance of the development of good health and safety records.

1.2 It is recognized that in many shipyards, standards for health and safety are already in effect which go beyond the requirements of those listed here. The Maritime Commission and Navy urge that any standards of higher level be continued and that where substandard conditions of health and safety exist, they immediately be brought to the required standard or better.

1.3 In all cases the use of the words *shall* or *must* indicates that compliance with that section of the minimum requirements is mandatory. Where the words *should* or *may* are used the section may be considered desirable but not necessarily mandatory under certain circumstances which the contractor in his discretion may determine.

MINIMUM REQUIREMENTS FOR INDUSTRIAL HEALTH

H-2. Medical Facilities.

2.1 *Personnel.*—Yards employing up to 5,000 men should have two full-time physicians, and one additional physician for each additional 5,000 men. Yards with less than 2,000 to 3,000 men will not need full-time physicians.

2.2 Specialists in the various branches of the medical profession available in the area should be consulted as indicated.

2.3 Yards employing up to 5,000 men should have in the main dispensary six full-time nurses and three additional nurses for each additional 5,000. Additional nurses will be required for first aid stations.

2.4 There should be at least three clerks employed in the medical department for each 5,000 employees.

2.5 One ambulance driver should be available per ambulance per shift.

H-3. Physical Facilities.

3.1 The medical department should be provided with:

a. A waiting room with suitable registration facilities.

b. A general treatment room.

c. An eye treatment room.

d. A minor surgery room.

e. A ward with three beds for the first 5,000 employees, and one bed for each additional 10,000.

f. Doctors' offices and private examining rooms.

g. A nurses' office and dressing room.

h. X-ray room for yards employing 5,000 men and above.

i. A physiotherapy room.

j. Toilet facilities for doctors, nurses, and patients.

k. A storeroom for general medical stores.

l. X-ray files and viewing room.

3.2 First-aid treatment rooms, manned by nurses, should be provided wherever there is overcrowding at the main dispensary and loss of time due to distance from shipways and shops. These sub-stations may be located under building ways or near locations where the number of men working is large so that the distance a man need travel to a sub-station will not exceed approximately 400 yards.

H-4. Equipment.

4.1 The following equipment should be provided:

a. One ambulance for each 15,000 employees, or reasonable fraction thereof, with an ordinary passenger car always in reserve.

b. In some yards a station wagon is used satisfactorily inside the yard and an ambulance used only for trips outside.

c. An X-ray unit for yards employing about 5,000 men and above.

d. Medical and surgical stores required for minor surgery, eye injuries and physiotherapy.

H-5. Records and Forms.

5.1 The following records and forms are recommended:

NOTE.—*In an emergency no form need be filled out.*

a. A form authorizing the workman to report to the medical department for examination or treatment issued by a foreman or leading man or other supervisor. This shall show time of issue, arrival at dispensary, discharge from dispensary and return to work.

b. Appointment form for revisits and retreatments issued by the physicians and nurses.

c. A disposition form issued by physicians and nurses indicating return to work, hospitalization, to home, or other disposition.

d. A complete and accurate permanent filing system recording personal data, nature and cause of injury, diagnosis, treatment, disposition, and results.

e. The necessary state and insurance company forms.

f. Daily report to the safety department showing all new cases for the day, together with the nature and cause of injury, and the *diagnosis*.

g. The adoption of the standard nomenclature when made available by the Council on Industrial Health of the American Medical Association, Chicago, Illinois.

II-6. Examinations.

6.1 Physical examinations to insure proper placement of employees shall be given.

6.2 Periodic check examinations shall be given men working in occupations potentially hazardous to themselves or others, as for example to crane operators, locomotive and hoisting and portable engineers. Periodic check examinations should be given men in jobs in which there may be health hazard, as for example to sand blasters, radium and X-ray workers, and paint sprayers.

6.3 Special examinations such as X-ray, serologic and urinalyses shall be given in the individual case as indicated and in accordance with local needs.

II-7. Air Raid Precautions.

7.1 The medical department shall locate, equip, and maintain such emergency first aid dressing stations as may be deemed necessary to handle air raid casualties.

7.2 A certain number of yard employees shall be trained in first aid procedures to render assistance to the medical department in handling air raid victims.

7.3 Close cooperation should be maintained with the local civilian defense officials in order that evacuation and care of air raid victims may be carried out to the best advantage.

7.4 In keeping with local army and navy regulations, steps should be taken to provide protection of dispensaries by sandbags, or otherwise, from fragments and concussion of bombs.

II-8. Responsibilities of the Medical Services.

8.1 Frequent inspection of the yard by the medical staff shall be required in order that physicians may become familiar with shipyard jobs and thus help intelligently in preventing accidents and occupational disease.

8.2 Close collaboration shall be maintained with the safety department especially in regard to records of accidents and absenteeism.

8.3 It shall be the joint responsibility of the medical and safety departments through the supplies department to know the composition of paints, thinners, paint removers, and other chemicals used in the yard, and to see that the workers exposed are protected by the best safety practices.

8.4 As in the general practice of medicine the confidential relations of doctor and patient shall be maintained.

8.5 It is certain that in the near future women in large numbers are to be employed in the mechanical trades. It is necessary in shipyards to make special provisions for this class of patients. This will necessitate the establishment of separate waiting, treatment, and examining rooms. In yards where the number of employees is large, it may be logical to establish a separate dispensary for the handling of women patients.

H-9. Sanitary Inspections.

9.1 *Cafeterias and canteens.*—It shall be the duty of the medical department to adapt from Army and Navy standards, in reasonable conformity with the local health department rules, and inspection scheme to include preemployment examination of food handlers, quality and quantity of food, general cleanliness and comfort, screening, dishwashing, garbage and waste disposal. These inspections shall be made at unscheduled times and never less than once each week.

9.2 *Water supply, sewerage, and waste disposal.*—In cooperation with Maritime and Navy engineers the medical department shall inspect and report upon the above as often as seems advisable, but not less than twice yearly.

9.3 *Salt tablets.*—Salt tablets shall be made available to all employees and shall be kept in covered dispensers appropriately located.

H-10. Respiratory Protective Equipment for Shipyards.

The U. S. Bureau of Mines, 4800 Forbes Street, Pittsburgh, Penna., maintains a laboratory which tests and *approves* for use in industry respiratory protective equipment of all kinds. The Maritime Commission and Navy will require the use of *approved* equipment throughout all yards. The safety department shall be responsible for instructing men in the proper use of such equipment and for the maintenance of ample supplies.

10.1 Details of Bureau of Mines respirators with names of manufacturers, prices, and descriptions can be obtained from the Bureau or from the Maritime Commission.

10.2 The safety department shall be responsible to the management for cleaning and sterilizing all such equipment as often as may be agreed upon with the medical department. (A method for such sterilization is included in these standards; see section H-12.0)

10.3 *General requirements for respirators.*—

a. Adequate protection as defined by American Standard Safety Code for the Protection of Heads, Eyes, and Respiratory Organs. Handbook H-24, Nov. 1, 1938. Superintendent of Documents, Washington, D. C.; price 15¢.

b. Comfort (light weight and not obstructive to vision).

II-11. Jobs Requiring Respiratory Protective Equipment.

11.1 *Dust.*—

JOBS	PROTECTIVE DEVICES
Silica or Sand Dusts (as in sand blasting)	(1) Abrasive blasting helmets. (2) Dust respirator.
Lead Dust (as in mixing paint)	(1) Air line respirator. (2) Lead dust respirator.
Asbestos (as in covering pipes)	(1) Air line respirator. (2) Dust respirator.

11.2 *Metal fumes and smokes.*—

JOBS	PROTECTIVE DEVICES
Lead and zinc oxide from welding and burning.	(1) Air line respirator. (2) Fume respirator for lead. (3) Dust respirator for zinc oxide.

11.3 *Solvent vapors.*—

JOBS	PROTECTIVE DEVICES
Spray painting, both indoors and outdoors. Paint removing, usually indoors. Cementing, usually indoors. Cleaning, usually indoors. Degreasing, usually indoors.	(1) Air line respirator. (2) Chemical cartridge respirator.

11.4 *Acid gases and mists.*—

JOBS	PROTECTIVE DEVICES
Pickling (indoors). Cleaning (indoors). Degreasing (indoors).	(1) Mist respirator. (2) Chemical cartridge respirator.

11.5 *Alkali mists.*—

JOBS	PROTECTIVE DEVICES
Cleaning (indoors). Degreasing (indoors).	(1) Mist respirator. (2) Chemical cartridge respirator.

11.6 *Asphyxiating atmospheres.*—

PROTECTIVE DEVICES

(1) Hose mask.
(2) Oxygen-breathing mask.
(3) All-service mask.

11.7 *Air supply for air-line masks of all kinds.*—Air at a comfortable temperature and free from odors and excessive moisture sometimes is difficult to furnish, especially for outdoor jobs in winter. Air quality and temperature shall be tested by the Safety Department and shall meet the suggestions of the American Standard Safety Code for air-supplied respirators (sec. 10.3a).

II-12. Sterilization of Respirators.

12.1 Each worker who needs a respirator should be assigned his own respirator. Where this is not done, it is important that the respirator be sterilized in addition to being cleaned. Adequate sterilization may be accomplished by—

a. Washing the rubber and metal parts with soap, a brush and warm water, after which the respirator is sterilized by immersion for 10 minutes in a solution of formalin made by placing one part of 40 percent formaldehyde solution into nine parts of water.

b. Washing the rubber and metal parts with soap and warm water, after which the respirator is sterilized by dipping in a 3 percent solution of carbolic acid, a 2 percent solution of lysol, or a 70 percent solution of denatured alcohol.

c. Subjecting the respirator to sterilization by a moist atmosphere of antiseptic gas, preferably formaldehyde, for a period of ten minutes at room temperature.

d. After following any one of the outlined procedures, the respirator should be rinsed with water and hung up to dry. The respirator should not be used until it has been dried thoroughly.

e. The filters, felt screens, and elastic headbands should be removed, if detachable, before washing or sterilization of the respirator, unless it is evident that washing and sterilization will not harm these parts.

12.2 The National Safety Council has issued an Industrial Data Sheet No. D-Gen. 16, "Cleaning and Sterilizing Goggles and Respiratory Equipment."

II-13. A Guide for Prevention of Industrial Disease in Shipyards.

13.1 Eight common types of disease and methods for their prevention are given in the following sections. Help in applying these methods will be given by the local Safety Department and by safety and medical consultants of the Navy Department and the Maritime Commission.

13.2 *Flashburns and foreign bodies in the eye.*—

a. Effects on workers: "Flash" is a surface eye burn resulting from even momentary unprotected exposure to the welding arc. In this condition the eye is painful and sensitive, especially to light. An eye flash shall be treated only by the doctor or by methods he has prescribed.

b. Foreign bodies in the eye shall be removed only under the doctor's orders or by methods he has prescribed. Like flashburns, they are preventable.

c. For safe practice:

All workers:

1. Whenever near welding areas wear antiflash goggles which have been approved by the Safety Department.
2. Wear safety goggles when grinding, chipping, buffing, scratch-brushing, or forging.

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Welders:

3. Wear approved antiflash goggles even when helmet is being worn.
4. Use portable screens to protect the eyes of fellow workers.

13.3 *Lead poisoning.*—

a. Sources: In general, any job in which dust, fume, or smoke from any substance containing lead is breathed daily.

b. For example:

JOB:	WHEN MATERIAL IS:
Welding	Metal, coated with paint containing lead.
Cutting	
Burning	Lead.
Shrinking	Lead pigments.
Grinding	
Buffing	
Spray painting	
Mixing paint pigments	

c. Job can be done safely with:

1. (a) Special ventilation: Use a local exhaust hood approximately 8 inches from the job and drawing at least 200 c. f. m. into the hood with filtration of the discharge, or discharge, to a place where the contaminated air will not be breathed, or
   (b) Wearing of fume respirators, or
   (c) Wearing of supplied air respirator.
2. Periodic medical examination which includes blood and urinalyses.

13.4 *Solvent vapors.*—

a. Sources: In general, any job in which solvent vapors are breathed. For example:

Spray painting.
Painting.
Using paint remover.
Applying cements.
Paint brush and spray gun cleaning.

b. Job can be safely done with:

1. Segregation of such work, and
2. (a) Special ventilation as may be required.
   (b) Provision of spray booths with exhaust system.

(c) Wearing of special respirators:

(1) For spray painting: Supplied air respirators or air line hoods.

(2) For other jobs: Chemical cartridge respirators.

(See H-10 on respiratory protective equipment.)

13.5 *Zinc fume fever (zinc chills or shakes).*—

a. Sources: In general, any job in which the fumes from heated zinc are breathed. For example:

JOB:	WHEN MATERIAL IS:
Welding	Galvanized metal
Cutting	Zinc
Shrinking	Zinc alloy
Pouring zinc alloys	Brass

b. Job can be safely done with:

1. Special ventilation: Local exhaust hoses or hoods located close enough to operation at all times to remove smoke completely.
2. Wearing of special respirators.

NOTE.—There are no known cumulative effects from zinc chills.

13.6 *Fiberglas.*—

a. Effects on workers: Men working with Fiberglas may develop a dermatitis or conjunctivitis which are skin and eye conditions. It is best to transfer to another job those who continue to be sensitive.

1. Both experimental and practical evidence show conclusively that the inhalation of Fiberglas causes no lung damage.
2. The cement used with Fiberglas may contain a toxic solvent such as carbon tetrachloride (CCl_4) which can cause severe illness or even death if the cement is used indoors with inadequate ventilation.

b. For safe practice:

1. Clothing: Supply loose coveralls with collars and sleeves buttoned over cheesecloth.
2. Goggles: Should be worn.
3. Shower: Should be taken rather than bath, at end of shift.

Respirators are usually not necessary, *but if* a cement containing a toxic solvent is used, proper protection either by ventilation or by a respirator must be supplied and used.

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13.7 *Asbestosis.*—

a. Sources: In general, any job in which asbestos dust is breathed. For example:

JOB:	WHEN MATERIAL IS:
Handling.	Asbestos
Sawing.	Asbestos mixtures.
Cutting.	
Molding.	
Welding rod salvage.	

b. Job can be done safely with:

1. Segregation of dusty work and,
2. (a) Special ventilation: Hoods enclosing the working process and having linear air velocities at all openings of 100 feet per minute, or
   (b) Wearing of special respirators.
3. Periodic medical examination.

13.8 Silicosis.—

a. Sources: In general, any job in which the dust of free silica (sand) is breathed daily. For example:

JOB
Sand-blasting
Sand packing of pipes
Shot blasting of castings

b. Job can be done safely with:

1. Isolation of dusty process and, in addition,
2. Special ventilation: In the case of sand-blasting, the work should be done in the standard type of sand blast room, cabinet, or machine.
3. Special respirator for dust-containing free silica.
4. Periodic examination by doctor.

13.9 Dermatitis.—

a. Sources: Excessive or improper use of cleaning agents such as gasoline. It is not at all uncommon to find dermititis caused by excessive use of common soaps such as those used in laundering. Cutting oils, certain greases, certain insulating materials used on electric cables and conduits can cause dermatitis.

b. Job can be done safely with:

1. Precautions against excessive use of the causative agent.
2. Advice of the medical department in the use of protective salves and creams.

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II-14. Ventilation Standards.

14.1 Ventilation is required to control temperature and to remove air impurities, as from welding and paint spraying.

14.2 The maintenance of proper working conditions shall be the responsibility of the safety department, whose staff shall work in close cooperation with the welding, paint, and electrical departments. Air analyses and tests shall be made by the safety and medical consultants of the Navy Department and the Maritime Commission as may be needed.

14.3 Personnel of Department.—

a. Number:

1. The size of the ventilation crew will vary with the type of ship, equipment available, etc. The head of the safety department will be responsible for the organization of the safety department or division.
2. There shall be a ventilation supervisor on each shift responsible to the head of the safety department. Under the supervisor there shall be a sufficient crew to inspect and maintain good working conditions.
3. An EC-2 ship shall have at least one ventilation man aboard. Larger ships, or ships like carriers with considerable galvanized welding, shall have at least two ventilation men.
4. The number of ventilation men on the night shifts shall be in proportion to the construction crews.
5. The ventilation crew must have available a maintenance and repair crew of sufficient size to keep equipment on the job and operating efficiently. Long waits during which equipment is idle must be avoided.

b. Training:

1. The ventilation supervisor (that is, the safety engineer) shall be trained to handle the entire ventilation program in the yard. Local educational institutions, State Industrial Hygiene Units, Maritime Commission engineers, and other sources are available to give this training.
2. The ventilation supervisor shall organize classes, demonstrations, and short talks on standard procedures for ventilating specific spaces on the ships.

14.4 *Type of equipment needed.*—In ship construction, two types of ventilation are used—local exhaust as for removal of welding fumes at the point of origin, and general ventilation to supply fresh air to confined working spaces.

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a. Local exhaust:

1. A common length for a local exhaust hose is forty feet. In ordering exhaust fans for use with local exhaust hoses, the following specifications should be met: Capable of drawing a minimum of 900 c. f. m. through each of 3-inch (or 4-inch) diameter flexible hose. Fans should have provisions for attaching three or more local exhaust hoses per unit.
2. In the interests of power economy, it is undesirable to move much more than 200 c. f. m. through each local exhaust hose.

b. General ventilation:

1. It is frequently desirable to introduce air into large working spaces such as deep tanks, fore- or after-peaks. This is done in many yards by using a flexible fabric duct, with metal elbows, and a fan of about 5,000 c. f. m. capacity.
2. It is desirable sometimes to supply a quantity of fresh air into the double bottom. Here a 2,000 c. f. m. unit may be used.
3. These two examples represent the two extremes of this type of work, and therefore are the two extremes in fan sizes. Fan static pressures in each case should exceed four inches of water.
4. For general ventilation of a ship engineroom during construction, a 10,000 c. f. m. blower is recommended. On the other hand, operations in confined quarters where heat is generated (plate shrinking, for example) may use a small portable fan to circulate the air. For this purpose, small blowers of from 800 to 1,500 c. f. m. shall be provided.

c. Ventilating procedures:

1. Local exhaust shall be used whenever a welding operation is being conducted in a confined space, or whenever galvanized metal is being welded. Local exhaust is always a suction process. Never blow a stream of air upon a welding arc.
2. Many welders think that it is enough to hold the end of the suction hose in the same compartment with the welding operation. This is not so. In order to capture the welding fumes, the end of the hose must be within six or eight inches of the arc, assuming a 200 c. f. m. volume per hose. Beyond this distance, the suction hose is ineffective.
3. The air supply to a general ventilation fan must be fresh outside air. Recirculation of air already contaminated shall not be permitted. A minimum of 400 c. f. m. per welder shall be supplied to a given working space such as a deep tank when general ventilation is used alone.

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4. In warm weather, air movements or drafts are helpful, while in cold weather a minimum of air movement is desired and local exhaust will serve best. In temperate weather, it is most satisfactory to use a combination of local exhaust and general ventilation.

14.5 *Coordination of department with construction program.*—

a. The ventilation supervisor shall keep abreast of construction, and thus anticipate the ventilation needs.

b. The construction foreman shall inform the ventilation department of ventilation needs before the needs occur.

c. Blackboards, boxes, signal lights, or similar devices shall be installed on board and used to inform the ventilation department of immediate needs.

14.6 *Supplementary ventilating procedures.*—

a. Ventilating confined spaces, such as the fore- or after-peaks and deep tanks, is greatly simplified by the temporary removal or cutting through of certain plates.

b. For example, the fore-peak of a Liberty ship can best be ventilated by cutting a combination access and ventilation hole through the watertight bulkhead near the ship's bottom.

c. The tank top can be left off of the midship deep tanks until all welding has been completed in this space.

d. A side plate can be left or cut out of the engineroom at the bottom deck level.

MINIMUM REQUIREMENTS FOR SAFETY

2-2. Management's Part.

2.1 It is absolutely essential, if a successful accident-prevention program is to be installed and operated, that top plant management take an active and interested part in the work. The same supervision given any other important activity in the shipyard shall be given the safety program.

2.2 The responsibility of management insofar as industrial safety is concerned shall be considered to include—

2.21 The provision of a safe working environment.

2.22 Training of employees for safety.

2.23 Establishment of an accident record and reporting system which will definitely tie into nationally uniform reporting, record, and statistical requirements.

2.24 The appointment, where necessary, of a safety engineer (or a safety director) and staff to install, maintain, and properly supervise an accident-prevention program.

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2.25 The issuance of instructions to all division or department heads, foremen, leaders, leadingmen and to any persons in supervisory capacity, that they are considered responsible for preventing accidents which involve employees working under their direction and requiring them to comply with all of the provisions of the accident prevention program in effect in the shipyard.

2.26 An active and interested participation in safety through—

(a) Review of, and executive action on, safety records.

(b) Regular attendance at safety meetings.

(c) Action upon good or bad departmental safety records through personal interviews with department heads.

(d) General letters, for bulletin board posting, addressed to employees and discussions of good or bad yard accident record.

(e) By setting a good example. (Goggles, safety shoes, hard hats and other necessary protective equipment shall be used by any executive who exposes himself to yard operations.)

S-3. Safety Director and Staff.

3.1 A full-time safety director (title may be safety engineer or safety inspector, etc.) and staff shall be appointed for all shipyards. (See Section 3.25 for duties and responsibilities.) The safety director shall report to, and be responsible to, the highest ranking managerial executive or his designated representative.

3.2 The staff in the safety department in addition to the safety director, shall consist of:

3.21 An assistant safety director in yards having 3,000 employees or more except that there shall always be at least one safety engineer per shift.

3.22 One safety engineer (safety inspector) for each additional 1,500 employees. Example: If a yard has 35,000 employees there would be required a safety director and an assistant plus 21 safety inspectors.

3.23 The staff of engineers shall be distributed over the three shifts in proportion to the number of employees on each shift.

3.24 One clerk and/or stenographer for the first 5,000 employees and one clerk for each additional 7,500 employees. (It is not to be assumed that the time of safety inspectors or the safety director can be spent on clerical detail. All office functions, while adequately supervised by the safety

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director, should be carried on by clerks so the greatest possible amount of time of the safety director and his staff may be spent in the shipyard.)

3.23 The duties and responsibilities of the safety director shall include:

(a) Complete responsibility for formulating, administering and making necessary changes in the shipyard accident prevention programs within the limits of authority granted by the shipyard management. The safety director shall also be required to correlate the shipyard accident program with the minimum safety and health standards of the United States Navy Department and Maritime Commission.

(b) Submission of regular monthly, weekly or daily reports on the status of safety directly to the general manager or his designated representative.

(c) Acting in an advisory capacity on *all* matters pertaining to safety to the management, general manager, superintendents, foremen, quartermen, leadermen, purchasing department, engineering department, commissary department, or contractors.

(d) Maintenance of the accident record system, making all necessary reports, personal investigation of all fatal or serious accidents, investigation through his staff of all accidents, securing supervisor's accident reports, checking corrective action taken by supervisors to eliminate accident causes.

(e) Supervising, or closely cooperating with the training supervisor in the safety training of all employees. (See Section 6.26.)

(f) Correlating safety work with medical department to insure proper selection and placement of employees.

(g) Making personal inspections and supervising inspections by staff and by special employee committees, for the purpose of *discovering and correcting unsafe conditions or unsafe work practices BEFORE THEY CAUSE ACCIDENTS.*

(h) Exchanging information with other shipyards on best safety methods and consulting with United

States Navy Department and Maritime Commission Regional Safety Consultants on safety problems which cannot be solved with methods or information at hand.

(i) Making certain that all federal, state or local laws, ordinances or orders bearing on industrial safety are complied with.

(j) Securing any necessary help or advice from the state labor departments on matters pertaining to safety and health.

(k) Initiating activities that will stimulate and maintain the interest of employees in safety.

(l) Acting as secretary of all safety committees and in such capacity he shall prepare an agenda for each such meeting covering the business to be discussed and, he shall prepare for the record, minutes of each such meeting.

(m) Directing the activities of his staff including the assistant safety director, so that the shipyard accident prevention program will be efficiently operated. It is expected that the safety director may delegate certain responsibilities to his staff engineers, such as that of acting as secretary of certain of the safety committees. Permission for such delegation of authority is expressly given in the interest of efficiency and for training the safety staff.

(n) Submission of the required reports on the status of safety in the shipyard to the interested government agencies at the time and intervals hereinafter requested.

3-4. Accident Prevention Forms and Reports.

4.1 The safety director shall cause to be designed and put into use at least the following forms and records:

4.11 *Supervisor's report of accident.*—

(a) Giving all vital data on case plus statements as to unsafe act and/or unsafe condition, reason unsafe act or condition was permitted to exist or occur, and the immediate corrective action taken or recommended. (See Form 1.)

4.12 *Safety engineer's recommendation form.*—

(a) Form used by safety staff to record recommendations made during inspection. Used for follow-up. Made in triplicate; one to leader-

Budget Bureau No. [illegible]
Approval expires January [illegible]

U. S. MARITIME COMMISSION — U. S. NAVY
PRIVATE SHIPYARDS
SUPERVISOR'S REPORT OF ACCIDENT OR OCCUPATIONAL DISEASE

Fill out for every disabling injury (or case of occupational disease) whether or not compensable. Answer every question fully. Use other side if necessary. To be mailed with the Monthly Injury Summary (for the month covered in that report) by the 15th of the following month to the Division of Industrial Injury Statistics, Bureau of Labor Statistics, Washington, D. C.

(1) Name of yard ______ (City) ______ (State)
(2) Name of injured employee ______ Badge No. ______
(3) Occupation ______ Department ______
(4) Date of accident ______ Hour of day ______ a.m. p.m.
(5) Witnesses: Name ______ Badge No. ______
" ______ " " ______
(6) Describe accident or case fully (what injured was doing, what happened, etc.) ______
(7) What unsafe condition caused accident or occupational disease? (Specify: broken ladder, defective staging, lack of ventilating equipment, etc.) ______
(8) What was done wrong (unsafely) that caused accident or occupational disease? (Specify: failure to wear provided goggles, overloading crane, using mushroomed chisel, failure to use respiratory protective equipment, etc.) ______
(9) Describe resulting injury or occupational disease. (Specify: lacerated hand, broken left leg, right thumb amputated, lead poisoning, etc.) ______
(10) What have you done to prevent similar occurrences? ______
(11) What do you recommend to prevent similar occurrences? ______
(12) Signed by: ______ Title: ______ Date: ______
Checked by: ______

DO NOT USE
Serial No. ______
Code date ______
Region ______
Location ______
Occupation ______
Dept. ______
Injury date ______
Time of day ______
Agency ______
Agency part ______
Uns. mech. cond. ______
Acc. type ______
Uns. act ______
Uns. pers. fact ______
Injury ______
Body part ______

Form 1. (See paragraph II. 4.11-a.)

SAFETY ENGINEER RECOMMENDATION FORM

BLANK SHIPBUILDING COMPANY

To: ____________________ Location ________________

Date ____________ Time ________________

An inspection of operations under your supervision revealed the following unsafe practices and/or conditions:

NOTE: (Unsafe acts or conditions to be described here and numbered. Badge numbers or names of men involved may be listed.)

Above conditions or practices last observed (1)________ (2)________ (3)________

Corrected at once?______ If not, when will corrective action be taken?__________

Signed ____________________
Safety Department

Date checked ________________ Signed ____________________
(Used only if condition is not corrected at once.) Safety Department

No. 000

NOTES:
(1) Size, approximately 5" x 5"
(2) To be made out in triplicate (See 4.12)
(3) Form need not be filled out if condition is corrected at once unless unsafe act or condition is a repetition or a flagrant violation of safety rules is involved.
(4) If check shows existence of same unsafe act or condition the matter should be referred in writing, to the proper executive for action.

man or quarterman on job, one to general manager, or other designated executive, one to safety department files after use to check performance. (See Form 2.)

4.13 *United States Navy Department and Maritime Commission monthly injury summary.*—

(a) To be submitted monthly to United States Navy-Maritime Commission. (See Form 3 attached.) To include over-all breakdown of predominant accidents, types and causes, accident frequency, total number of fatal cases, total of lost-time cases and the time lost, etc. *This form to be used also for report to management of shipyard.* To be submitted in triplicate as required on form. (See Form 3.)

(b) The following formula shall be used in determining accident frequency rates for shipyards:

1. Accident Frequency=

$$\frac{\text{Number Disabling Injuries} \times 1{,}000{,}000}{\text{Total Man-Hours Worked for Period Covered}}$$

2. A disabling injury shall be considered to be any injury which results in a man being unable to report for work on the next regular day or shift after the accident, or one which calls for a standard time charge being made regardless of whether time is actually lost. If time is lost due to the injury, subsequent to the initial return to work, then the injury shall be accounted as disabling.

4.14 *Minutes of safety committee meetings.*—

(a) Minutes of meetings should show date and time of meeting, names of those present, action on unfinished business, brief description of new business discussed and action taken or ordered by the committee on each item. The discussion should always include the predominating accident hazards of the yard and the means suggested to control them.

(b) Various committee forms will be made available to shipyards on request.

4.17 These forms and any others pertaining to industrial safety or health shall be filed and made available to authorized

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[illegible]

U. S. MARITIME COMMISSION — U. S. NAVY
PRIVATE SHIPYARDS

INJURY SUMMARY FOR MONTH OF ________________, 19__

[illegible]

1. Name of shipyard ________________

2. Location of shipyard ________________ [illegible] [illegible]

EXPOSURE DATA

3. Average number of employees ________ [illegible] 4. Total employee-hours worked during month ________

INJURY DATA

Disabling Injuries

	Number		Days Lost	
	[illegible] (a)	[illegible] (b)	[illegible] (c)	[illegible] (d)
5. Fatalities				X X X
6. Permanent impairments				
7. Temporary total				
8. TOTAL		X X X		
9. Non-disabling injuries		X X X	X X X	X X X

[illegible]

10. Frequency rate ________________

11. Yearly frequency rate to date ________________

Comments ________________

Report made out by ________________ Title ________________ Date ________________

INSTRUCTIONS

1. [illegible]

2. [illegible]

3. [illegible]

(Over)

FORM 3-Front. (See paragraph 3. 413-a.)

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ACCIDENT CAUSE ANALYSIS FOR THE MONTH

Unsafe condition or practice (If more than one item applies, give preference to the one appearing first on the list)	[illegible]		
	Total		Resulting in injuries during the month
	This month	Year to date	
a. [illegible]			
1. [illegible]			
2. [illegible]			
3. [illegible]			
4. [illegible]			
5. Other (specify)			
b. [illegible]			
1. [illegible]			
2. [illegible]			
3. [illegible]			
4. [illegible]			
5. [illegible]			
6. Other (specify)			
c. [illegible]			
1. [illegible]			
2. [illegible]			
3. [illegible]			
4. [illegible]			
5. Other (specify)			
d. [illegible]			
1. [illegible]			
2. [illegible]			
3. Other (specify)			
e. [illegible]			
1. [illegible]			
2. [illegible]			
3. [illegible]			
4. [illegible]			
5. Other (specify)			
f. [illegible]			
1. [illegible]			
2. [illegible]			
3. [illegible]			
4. [illegible]			
5. [illegible]			
6. [illegible]			
7. [illegible]			
8. Other (specify)			
g. [illegible]			
1. [illegible]			
2. [illegible]			
3. Other (specify)			
h. [illegible]			
1. [illegible]			
2. [illegible]			
3. [illegible]			
4. [illegible]			
5. [illegible]			
6. [illegible]			
i. [illegible]			
1. [illegible]			
2. [illegible]			
3. [illegible]			
4. [illegible]			
5. Other (specify)			
j. [illegible]			
k. [illegible]			
l. All others			

representatives of the United States Navy-Maritime Commission upon request.

5-5. Safety Committees.

5.1 The safety director, in cooperation with the shipyard general manager, shall cause to be formed and put into effective operation at least the following safety committees.

5.11 *Central safety committee.—*

(a) Membership: management representative (chairman), safety director (secretary), all superintendents, foremen, medical department representative, quartermen or leadermen, and one employee.

(b) Membership of all but management representative, medical department representative and safety director may be rotated—terms of 3 months each but rotation to be arranged so only ⅓ of committee changes each month.

(c) Meetings: Shall be monthly or more often as necessary.

(d) Duties: This is the policy forming committee for safety work. They review the monthly report as submitted to the United States Navy-Maritime Commission and other records to determine the course of safety work for coming period. They decide such matters as type of safety equipment to be used and how it shall be made available to men, types of safety training to be used, whether accident prevention plan is being adhered to, interplant contest awards, etc. Such committees shall review the investigation on fatal or serious accidents and make recommendations. All Committee members are expected to make practical suggestions to improve shipyard safety. They also review reports of other committees to make certain suggestions and recommendations are properly followed through.

(e) Secretary: The safety director shall act as secretary, prepare an agenda, take minutes, prepare a report of committee meeting, and distribute copies of reports to members. He shall follow through with other committees, the suggestions and recommendations of the central safety committee.

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8.19 *Supervisors' safety committee.*—

(a) Membership: Management representative, safety director, medical department representative, superintendents, foremen, quartermen, and leadermen. This is a rotating committee; rotation should be arranged so all of the supervisory staff serve in their respective periods, i. e., superintendents change each four months, foremen each two months, quartermen and leadermen each month. In no case should an entire group change at one time. Where a department or unit of a department has an unusually poor record then the responsible supervisory staff—superintendent, foreman, quartermen or leadermen should be retained on the committee until their record is at least equal to the shipyard average.

(b) Meetings: Shall be monthly or semimonthly or more frequently, as necessary.

(c) Duties: The primary purpose of this committee is the stimulation and maintenance of interest and the education of its members in accident prevention. The shipyard accident record shall be reviewed, the predominant types of accidents and the predominant causes of these accidents shall be discussed. Suggestions and recommendations to improve the records are solicited from each member. At least one timely subject must be discussed at each meeting; i. e., such as eye injuries and their prevention, electric shocks, hand tool accidents, etc. Methods of avoiding accidents due to these operations should be presented by the committee members.

(d) The committee shall review reports of all fatal and serious accidents and suggest preventive action. It shall review reports of inspection committees and check on the quality of the suggested corrective action for unsafe conditions or practices reported.

(e) The committee shall carry out the suggestions and recommendations of the central committee.

(f) Outside speakers such as safety engineers, insurance men, State Department of Labor men or men from other shipyards, may be used from

time to time to stimulate interest of committee members in accident-prevention work. Sound film strips, motion pictures or other similar media on safety subjects can and should be used if available and practicable.

(g) Secretary: Same as for central safety committee.

5.13 *Regular inspection committees.*—

(a) Number: One committee for each department and each hull.

(b) Inspection: Weekly or more often as necessary.

(c) Membership: At least two employees and a supervisory employee of each job being inspected. The safety director or staff safety engineer should accompany the committee.

(d) Duties: To inspect their department or hull for the purpose of discovering and having corrected unsafe acts and unsafe conditions likely to cause accidents. On each section of a job they should be accompanied by a responsible supervisory employee. They are observers only—the foremen, quartermen or leadermen shall do all corrective work. Where a condition is discovered on which there is disagreement the superintendent shall make the necessary decision. *Hazards immediately dangerous to health, life or limb shall be corrected by the accompanying supervisor at once.*

(e) The committee shall submit written reports to the safety director and indicate whether accident-producing conditions or practices have been corrected. These reports shall be referred to the supervisory safety committee by the safety director. If necessary because of dangerous conditions, he may refer them at once to the general manager.

5.14 *Special inspection committees.*—

(a) Staging inspectors, electrical inspectors, crane inspectors, boiler inspectors, and others.

(b) Membership: Specially qualified individuals or teams permanently assigned to work. (See paragraph 5.15c.)

(c) Duties:

1. Staging inspectors: Daily or continuous inspections of all stages shall be made on each

hull—or other locations where stages are used. Report shall be made of all defects to the responsible supervisor for immediate correction. Copy of the daily report shall be submitted to the safety director.

2. Crane inspectors: Weekly inspections shall be made of all cranes and rigging. Reports shall be submitted to proper department heads for correction of unsafe conditions or practices. Copies of reports on defects shall be made to the safety director.
3. Other inspectors: As above and at indicated frequency.

5.15 *Safety committees—General.—*

(a) Committees in addition to those specified in these standards, may be formed and operated if desired.

(b) Representatives on all committees, when of a supervisory status, should be appointed by the shipyard general manager and held responsible by him for active and interested participation in the work of the committee. Employee representation may be secured in the same manner, or by appointment of employee committees, union shop stewards or by election of union members or by any other feasible means.

(c) The services of production employees having related duties may be taken advantage of on inspection committees. Stage erectors or repair man may serve as permanent and continuous staging inspectors, a man or men from the ventilation crew may be utilized for checking on ventilation practices. The reports of state or insurance inspectors will be considered adequate on boilers, air compressors and receivers or on other pressure vessels.

S-6. Employee Safety Training.

6.1 The time for the safety training of an employee to start is at the inception of his employment. After a physical examination, which should be made to make certain that the employee is physically capable of performing safely the work he is requesting, the man shall have explained to him the safety policy of the company by a representative of the safety department. This may be done individually, in general groups or in craft groups and the instruction may

be supplemented by printed instructions in the form of rule books or instruction cards.

6.2 Employees shall have in their possession, and be instructed in the proper use of, all necessary personal protective equipment before being started on any job.

6.3 General safety rule books, craft safety rule books or safety instruction cards should be supplied employees. Such books should be concise but complete enough to furnish written record of all important safety rules. *No rule shall be included which will not be strictly enforced.* The assistance of United States Navy-Maritime Commission safety engineers will be given in the preparation of such rule books if desired.

6.4 All employees shall be instructed in their specific duties by their immediate supervisor and they shall be made familiar with the hazards of the job and instructed carefully in how to avoid them. It shall further be the duty of the supervisor to constantly check all employees so unsafe working practices may be corrected before accidents occur.

6.5 Safety instruction shall be correlated with all apprentice and craft training schools. Safety instruction in such schools or training courses shall include an explanation and demonstration of the need for the safety equipment or safe practices specified and the strict enforcement of all safety requirements in the classes. The instructors shall, by their own example, impress upon the learners the importance of the safety requirements.

6.6 Safety bulletin boards shall be located at each hull and shop, and at such other locations where they may be desirable, on which safety posters, letters or bulletins from the shipyard management or safety department and other safety material may be posted.

6.61 The bulletin boards shall be located where the majority of the employees at a particular location will see them.

6.62 The bulletin boards shall be well constructed, have a locked glass cover and shall be lighted at night.

6.63 Safety posters and other material on bulletin boards shall be changed at least semimonthly or more often. (Posters will be made available by the United States Navy-Maritime Commission for the use of shipyards. However, posters may be selected by the shipyard safety department from any source.)

6.7 Where shipyard house organs (magazines or newspapers) are established, the safety director shall arrange to have a reasonable proportion of the space devoted to safety (articles, items and cartoon cuts relating to safety will be made available by United States Navy-Maritime Commission safety consultants.)

6.3 Sound-film strips and motion pictures on safety subjects should be used where practicable. Public address systems, where installed, may be used for safety messages to shipyard employees especially during lunch hours or at shift changes.

S-7. *Safety Supply Store.*

7.1 A safety supply store shall be established in each shipyard where safety shoes, safety hats, protective impact goggles and filter-lens welding goggles shall be made available to shipyard workers. Shoes may be sold at or near cost to employees, but safety hats and impact and filter-lens goggles shall be issued to each employee but shall remain the property of the company to be returned when the employee ends his employment. Equipment such as work clothes, gloves, welders helmets, may also be stocked and sold to employees if desired.

7.11 Goggles may be stocked in the central tool room or first-aid department but should be fitted as described in paragraph 7.2 following.

7.2 The attendant of the safety store should be skilled in fitting safety shoes, and if goggles are also issued, he should be trained in proper fitting and servicing of goggles.

S-8. Goggles.

8.1 Impact-resisting goggles of a type suitable for the particular job and also of a type meeting the requirements of the United States Bureau of Standards, shall be worn by every employee exposed to the hazard of eye injuries. Practically every employee in the shipyard, with the exception of those working inside offices at all times are either directly exposed to eye injury from the work they do, or indirectly through working near operations which are likely to produce flying objects. (See paragraph H-10.3a, page 4.)

8.2 Except where *temporary* lack of goggles make it impossible, each employee shall have his own pair of goggles. If it is necessary to reissue goggles to different employees, *the goggles must be sterilized after each use.*

8.3 Goggles supplied employees should be carefully fitted to their face to prevent irritation and to prevent the entrance of foreign objects around the edges. (See paragraph 7.2.)

8.4 All employees working in proximity to arc-welding operations shall be required to wear anti "flash" goggles, of at least No. 3-5 shade (or equivalent), of a type meeting the requirements of the United States Bureau of Standards. (See section 9.1 on welding for additional eye protection for welders.)

8.5 Welding screens constructed of wood, metal or other suitable material shall be used to protect the eyes of workers in proximity to electrical welding operations, whenever their use is practicable.

3-9. Welding—Arc.

9.1 All welders shall be made familiar with the hazards of their work and instructed in safe methods of performing the various types of jobs to which they are assigned.

9.2 Personal protection equipment used by welders shall include:

9.21 Welders' protective hood provided with the proper shade of filter type lens for protection against the harmful rays of the arc and a clear cover glass to protect the filter lens.

(a) The shades or their equivalent recommended are:

Up to 30 amperes—No. 6-7 Shade.
30 to 75 amperes—No. 8 Shade.
75 to 200 amperes—No. 10 Shade.
200 to 400 amperes—No. 12 Shade.
Over 400 amperes—No. 14 Shade.

(b) Shades may also be selected from the following table:

Rod diameter	Welding glass shade No.
1/16	10
3/32	10
1/8	10
5/32	10
3/16	12
7/32	12
1/4	12
5/16	14
3/8	14

(c) The welder's hood should be inspected at least weekly to detect possible light leaks, cracked protective glass, or badly fouled or missing cover glasses. Any defects discovered shall be corrected at once.

9.22 Protective leather welders' jacket, long-sleeved wool shirt with buttoned collar and leather welders' gloves and safety hat.

(a) It has been found satisfactory in the hot summer months to substitute flameproofed cotton shirts. If this is done, the flameproofing, which must must be reapplied after each washing, should be done under the direction of the shipyard. This entails that laundering also be done by the company. Commercial laundries are rapidly undertaking this type of work.

9.23 Hardened and filter lens protective goggles with sideshields to be worn under the hood for protection against harm-

ful rays where the hood is raised and for protection against flying scale and chips. The goggles should be of a type meeting the requirements of the United States Bureau of Standards and of at least No. 2-4 shade or equivalent.

9.24 Safety shoes or pull-on boots with cord or leather soles and heels.

9.3 Welding screens (constructed of flameproofed fabric on wood or metal frames, metal on metal frames, or plywood sheets joined by rings) of a size sufficient to protect men working nearby from the harmful effects of the electric arc rays shall be used on all electric welding operations when practicable.

9.31 A type found very successful by one large company can be economically constructed of ¼" to ⅜" plywood. Two pieces about 18" x 30" are joined at two points along one edge with 2" x ½" rings. The large size of the rings allows the two pieces to lap sufficiently to make a lightproof joint, while the light weight of the assembled screen makes men more prone to use them.

9.4 Welding leads shall be inspected at least once each shift, and those found defective shall be repaired or replaced.

9.5 All welding leads should be coiled back to centrally located stations after the completion of each shift or job.

9.6 Welding rod tips should not be thrown on decks or stages but should be retained by the welder and turned in at the end of the day for salvage.

9.7 Each electric welder shall make an inspection of the area below him, and of the opposite sides of bulkheads on which he is working, to make certain that there is no danger of falling or penetrating sparks causing a fire. He and his helper must know the location of fire extinguishing equipment and how to use it. It is recommended that a fire extinguisher be available in the immediate area.

9.8 The safety of women welders presents several special problems which should be carefully considered while women are being trained and during their first several weeks on the job.

9.81 Women will at first be subject to excessive fatigue because they are unaccustomed to shipyard work. In their enthusiasm they are likely to overdo and will, under such conditions, be more prone to accidents and at the least, absences may follow. They should, until they become accustomed to the work, be carefully watched by supervisors and if signs of fatigue are evident they should temporarily be given lighter work.

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9.52 Work clothing for women is still in the development stage. In general, however, the following should be observed:

(a) Safety shoes or pull-on boots with cord or leather soles and heels.

(b) Long underwear, union suit type (wool for winter) khaki trousers and shirt, or coverall type of overall with a drop seat and welders' leather uniform.

(c) It is desirable that the outer clothing, unless of wool, be flameproofed.

(d) Leather gloves.

9.53 Whenever possible, mechanical means of handling material should be utilized in preference to manual handling.

S-10. Burners.

10.1 Equipment for burners shall be the same as that for welders except that the leather clothing and welders' helmets need not be worn. Filter type lens protective glasses with side shields. No. 3–6 shades or their equivalent should be worn. Flameproofed clothing is desirable.

10.2 All individual oxygen and acetylene and other gas lines shall be turned off at the manifold at lunch hour and at quitting time or if the burner must leave the immediate vicinity of his work during the regular shift.

10.3 All hose should be coiled up to the manifold when shifts are changed or when jobs are completed.

10.4 The practice of dusting the clothes by blowing oxygen on them or using oxygen for ventilating or cooling purposes has resulted in several fatalities and *shall be absolutely forbidden*. Oxygen shall be used only in connection with burning or welding operations.

10.5 Each burner shall make an inspection of the area below him, and of the opposite sides of bulkheads on which he is working, to make certain that there is no danger of falling sparks causing a fire. He and his helper should know the location of fire-extinguishing equipment and how to use it. It is recommended that a fire extinguisher be available in the immediate area.

10.6 Burners' uniforms (overalls) shall be laundered at least weekly except that if oil or grease is spilled on the clothing, it shall be changed at once. It is desirable that arrangements be made by the company to have uniforms (overalls) laundered and flameproofed.

10.7 Defective burning equipment such as torch, hose or cylinder pressure regulators (where cylinders are used), shall be repaired immediately.

10.8 All oxygen and acetylene (gas) lines shall be inspected at least once each shift and those found defective shall be repaired or replaced.

10.9 Standard color coding for oxygen and acetylene pipe lines shall be observed for oxygen and acetylene. (Since it may be impos-

sible to secure colored hose during the war, identification may be made by any practicable means so long as every burner and burner's helper or any other person who has occasion to use oxygen-acetylene (gas) equipment is thoroughly familiar with it.)

S-11. Cranes (Whirleys, Hammerheads, Bridge, etc.)

11.1 The safe loads as specified for cranes on single lift shall not be exceeded.

a. For the guidance of crane operators, weights of all sections over 5 tons shall be plainly marked on the section in figures at least 12 inches high.

11.2 On double lifts, cranes shall not be loaded to more than 75% of their combined rated capacities.

11.3 All crane operators shall be given a thorough physical examination upon employment and at at least yearly intervals thereafter. Particular attention should be given to the eye examination.

11.4 Crane inspectors. (See section S. 5.14.)

11.5 All whirley and hammerhead cranes shall be provided with bumper guards of ¾" wire rope or equivalent set from 32 to 36 inches from the ground, and fastened in the form of a half loop to all four wheel covers at the leading and trailing ends of the crane.

11.6 All traveling cranes regardless of the type shall be equipped with a clearly audible automatically operated signal which will indicate that the crane is in motion. A siren or electric horn pitched to a tone above or below the general noise level of operations is preferable to a gong or bell.

11.7 The crane operator shall take signals only from the designated hook tenders or riggers and no others. Hook tenders shall be identified by special hats or arm bands.

11.8 All loads shall be lifted or lowered under power.

11.9 Employees shall not be permitted to pass between the leading and trailing trucks of whirley cranes AT ANY TIME.

a. Wheel covers shall be provided which will protect all wheels of whirley, gantry, hammerhead and bridge cranes to a distance of ½ inch from the crane tracks.

11.10 Employees shall not remain under, or pass under crane loads.

11.11 Trolley lines for cranes shall be protected against accidental contact by men or material, by wood or other suitable sheathing, or if the trolley lines are elevated they shall have a vertical clearance of at least 12 feet above the ground.

a. Bumper guards for trolley ends of bridge cranes should be provided to prevent the hoisting cables from swinging into the trolley wires.

11.12 The crane operator shall be required to immediately notify a designated department head of any defects he notices in the crane or its equipment.

11.13 No person other than the crane operator, a trainee, the supervisor in charge of cranes, the crane inspector, repairmen on crane repair jobs or safety department men shall be permitted in crane cabs. No more than three persons shall be in the cab at any time.

a. Whenever possible, crane operators should be relieved on the ground and not in the crane cab.

11.14 Except under emergency conditions and then only with the approval of the safety department, men shall not ride loads. Men shall never be permitted to ride empty hooks or slings.

11.15 A clearance of at least 2 feet and preferably more shall be maintained between the crane and any stationary object or materials. Where existing structures make this clearance impossible, an exception to this rule may be granted by the United States Navy-Maritime Commission Safety Consultant after an inspection.

11.16 Strong-backs or spreaders should be used on all lifts where there is danger of the load buckling or where the spread is so wide slings or clamps may slip. Steel strong-backs are preferable to wood.

11.17 The hook tenders shall familiarize themselves with the weights of the various plates, shapes and sections handled, so chain or cable slings of the proper size will be used on lifts.

11.18 All chain and cable slings and strongbacks should be clearly marked, by color coding, to indicate the maximum safe load for which they are to be used.

11.19 All electric cranes should be equipped with limit switches to prevent double blocking.

11.20 Storage racks shall be provided for all chain and cable slings at points convenient to the operations so they may be safely stored when not in use. All chain and cable slings shall be inspected before each use by the hook tender and if found defective, shall be sent to the proper department for repair. Such inspections shall be in addition to, not substitutes for, the regular inspections by the safety department.

3-12. Plant Housekeeping.

12.1 Housekeeping shall be maintained at a high standard in all parts of the shipyard at all times. The following rules shall (or should, as indicated) be put into effect:

a. Wide, well-defined roads, aisles, and passages shall be laid out in the yard and shops and they shall be kept clear of obstructions and shall be kept clean and free from debris. The width of aisles and passages in some of the older yards may be limited because of exist-

ing structures, but an effort should be made to maintain a width of twice that of the widest hand or power truck, plus two feet.

12.12 Aisles and passages should be defined by white or yellow lines painted on the floors. Materials or machines should not be permitted to encroach on these lines into the aisle.

12.13 All staging platforms, ramps, stairways, walkways, or other walkway surfaces on shipways shall be kept clean of all debris such as welding rod tips, bolts, nuts, and similar material. Welding leads, burner hose and air hose should be elevated over or placed under the walkway surfaces or protected by cross-over planks. They should be neatly arranged and not left in coils or loops where they may cause men to trip and fall.

12.14 All deck areas on hulls shall be kept free of debris and construction material shall be neatly piled so as not to present a hazard to employees. (See par. S. 12.13 on hose, etc.)

12.15 All deck openings shall, as soon as practicable, be protected with guardrails at least 42 inches in height set 12" back from the edge of the opening. Manholes may be guarded by tacking three uprights to the deck and then tacking a ring of the proper diameter to the top of the uprights. Hatches, without coamings, may be guarded by tacking uprights to the deck at intervals of not more than 10 feet and fastening 2" x 6" or 2" x 8" timber rails in place at 42" from the deck. Midrails set 21" from the deck may be used also, and are especially recommended where women are employed.

(a) Where they are projecting stud bolts around the manholes or tank tops, they should be protected with either metal strips or wood covering to prevent slips and falls or snagging of clothing of workers.

12.16 All snow and ice shall be cleaned from stagings and platforms (by turning the planks), and from decks, before men on regular production are permitted to work on them.

12.17 Free access shall be maintained at all times to all exists and to all fire-alarm boxes or fire-extinguishing equipment.

12.18 All oils, paints, thinners, solvents, waste, rags, or other flammable substances shall be stored and used strictly

in accordance with the requirements of the National Fire Protection Association standards.

12.19 All staging lumber, or other lumber, when dismantled shall have all nails or spikes removed or bent over.

12.20 Plates and shapes shall be stored either in substantial metal or heavy timber racks or stored flat on a substantial timber or concrete foundation that will prevent shifting.

(a) Plates and shapes shall be stored so there is at least an 8-foot clearance from the center line of railroad tracks.

12.21 Angle brackets and similar small pieces shall be stored in racks.

8-13. Lighting.

13.1 A level of illumination should be maintained for the various type of jobs in all shops, at least as high as that recommended by the standards of the Illuminating Engineering Society.

Minimum Standards of Illumination for certain industrial interiors as recommended by the Illuminating Engineering Society are as follows:

Type of Work	Minimum operating foot-candles—measured on the work
Assembly:	
Rough	10
Medium	20
Construction—Indoor:	
General	10
Forge shops and welding	10
Foundries:	
Charging floor, tumbling, cleaning, pouring and shaking out	5
Rough molding and core making	10
Fine molding and core making	20
Machine shops:	
Rough bench and machine work	10
Medium bench and machine work, ordinary automatic machines, rough grinding, medium buffing and polishing	20
Paint shops:	
Dipping, simple spraying, firing	10
Rubbing, ordinary hand painting and finishing; art, stencil and special spraying	20
Power plants, engine rooms, boilers:	
Boilers, coal and ash handling, storage battery rooms	5
Auxiliary equipment, oil switches and transformers	10
Engines, generators, blowers, compressors	15
Receiving and shipping	10
Sheet metal works:	
Miscellaneous machines, ordinary bench work	15
Punches, presses, shears, stamps, welders, spinning, medium bench work	20

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Type of work	Minimum operating foot-candles—measured on the work
Steel and iron manufacturing:	
Billet, blooming, sheet bar, skelp and slabbing mills	5
Boiler room, powerhouse, foundry and furnace rooms	5
Cold strip, pipe, rail, rod, tube, universal plate and wire drawing	10
Repair shops:	
Rough bench and machine work	10
Medium bench and machine work	20
Blacksmith shop	10
Carpenter and pattern shop	20
Storage	2
Store and stock rooms:	
Rough bulky material	5
Medium or fine material requiring care	10
Structural steel fabrication	10
Woodworking:	
Rough sawing and bench work	10
Sizing, planing, rough sanding, medium machine and bench work, gluing, veneering, cooperage	20

13.2 All lights should be provided with reflectors suitable for the type of work being done and meeting the requirements of wartime dim-out regulations. A regular schedule of cleaning and maintenance should be instituted that will keep the lighting units at their original efficiency.

S-14. Hand Tools.

14.1 All tool rooms issuing hand tools such as hammers, sledges, chisels, spud wrenches, center punches, portable air-driven tools, portable electric tools and other tools should be inspected daily by a safety engineer to make certain that only tools in good condition are being issued. Tools in poor condition shall not be issued.

14.2 Workers' personal tool kits should be inspected at monthly intervals so defective tools may be discovered and repaired.

S-15. Handling Material (Manual).

15.1 All employees should be instructed in the proper method of lifting. No limit can be set as to the maximum weight to be lifted by one man, but it should be made clear to all employees that they should secure help if the load is too heavy or too bulky for one man to handle easily. Mechanical equipment should always be used when it is available and its use is practicable.

15.11 Posters illustrating the proper method of lifting should be displayed frequently and men observed lifting incorrectly should be reinstructed by their supervisor.

S-16. Machine Guarding.

16.1 All belts, pulleys, gears, chains, sprockets or other dangerous moving parts of machines shall be completely enclosed with guards

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constructed of angle-iron brackets covered with heavy sheet metal or ½-inch wire mesh. Vertical or inclined belts shall be guarded to a height of 6 feet above the floor. Horizontal belts over 8 feet above the floor may be guarded only on the under side. Gears, chains and sprockets should be guarded no matter where located.

16.11 Since metal may not be available for guards at present, substantially constructed wood guards will be acceptable.

16.12 In all cases where state requirements are more stringent than those given above, the state rulings must be followed.

16.2 All machines shall be guarded at the point of operation so employees will not be injured while operating the machine.

16.21 The standards of guarding for the various machines as recommended by the Insurance Rating Bureau should be followed except where state requirements are more stringent when the latter will take precedence.

S-17. Staging and Ladders.

17.1 United States Navy—Maritime Standards of Construction for shipyard staging is in the process of development and will replace the present recommended practice when published.

17.2 All staging, scaffolding, platforms and walkways shall be constructed in accordance with the requirements of the California State Industrial Commission except where existing state codes are more stringent in which case the latter shall take precedence.

17.3 All ladders should conform to the American Standard Safety Code on ladders.

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U.S. Department of Transportation
Maritime Administration

Certificate of True Copy

I HEREBY CERTIFY *that the annexed* is a true copy of a document entitled "Minimum Requirements for Safety and Industrial Health in Contract Shipyards", consistic of thirty-five pages, as it appears on file.

in the Maritime Administration, U.S. Department of Transportation

IN WITNESS WHEREOF, I have hereunto set my hand, and caused the seal of the Maritime Administration to be affixed, on the day and year below written.

Secretary
Maritime Administration

Washington, D.C. October 4 19 83

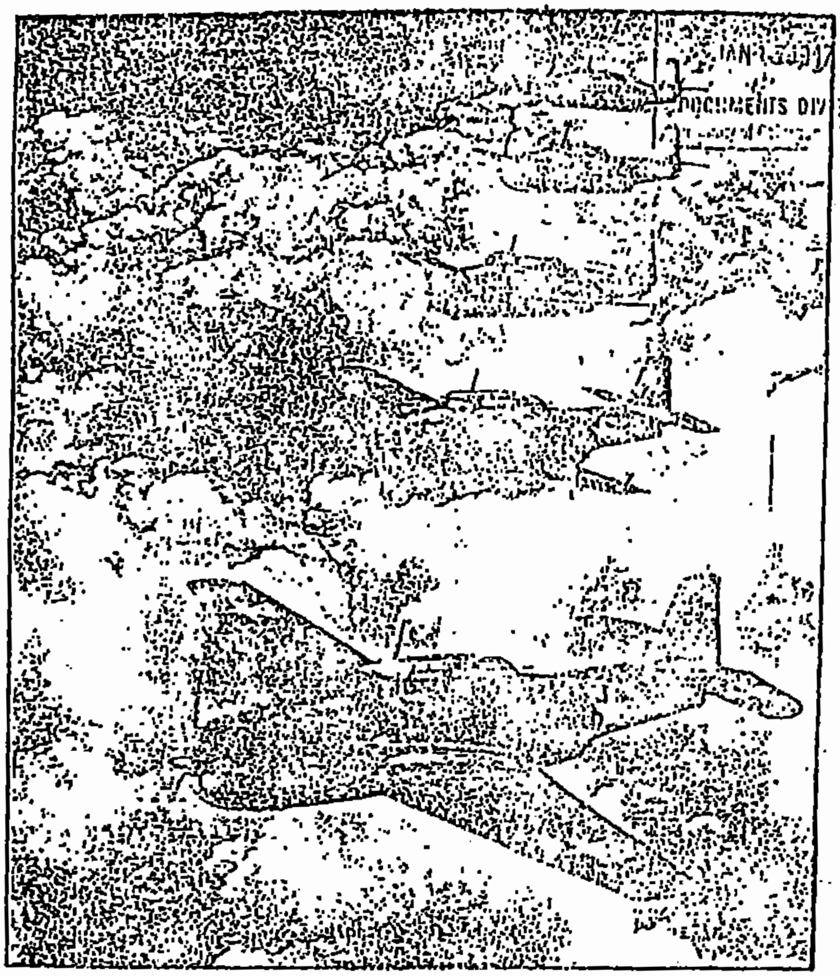
Form MA-93
(Rev. 9-82)

DH EXHIBIT 3
DATE: 12-11-95
WITNESS: Hugh Sim
RENEE C. ROBERTS, N.P.

DEFENDANT'S EXHIBIT
HXP/STC 53

EXHIBIT I

SAFETY REVIEW



NAVEXOS P-52

Vol. 4, No. 1
Jan. 1947

J-H EXHIBIT 12(c)(1)

DEPOSITION EXHIBIT
PNS 26
7/13/18 KAD

DEFENDENT'S EXHIBIT
Buffalo Pumps
65

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FOUNDRY DUST

ONE of the elements in effective control of silicosis in foundry operations is the maintenance of the highest standards of housekeeping. One phase of the housekeeping program should include periodic removal, on a scheduled basis, of the dust which has settled on overhead obstructions, girders, conduits, catwalks, and other fixed objects where dust in the general atmosphere may settle and come to rest. Several of the shore establishments, realizing the importance of good housekeeping conditions in keeping down concentrations of dust in the general foundry atmosphere, make use of industrial vacuum-cleaning systems for the periodic removal of dust which has settled on overhead structural members and equipment.

The importance of developing and maintaining such a housekeeping program is emphasized in the following report submitted recently by the Boston Naval Shipyard:

"Personnel working in the foundry have complained of the material which is deposited overhead and elsewhere in the foundry and drops down when the building vibrates; a laboratory analysis of a sample of this deposit follows:

Tin	(as SnO_2)	...... 9.64
Lead	(as Pb)	...... 2.09
Copper	(as Cu)	...... 2.06
Silica	(as SiO_2)	...... 2.64
Sulphur	(as S)	...... 4.90

Zinc Oxide ......The remainder, with the lead, copper and part of the zinc present as sulfides in the sample.

"In that the inhalation of heavy metal dusts is considered a contributing factor to metal-fume fever, the need for protective measures is obvious and again urged."

ASBESTOS DUST

EXPOSURE to asbestos dust is a health hazard which cannot be overlooked in maintaining an effective occupational-hygiene program. Adequate localized ventilation to maintain dust concentrations below the safe threshold limits must be utilized wherever possible, and, if circumstances warrant these should be supplemented by general-room ventilation. Activities engaged in the handling of asbestos installation and pipe covering should thoroughly investigate the environmental conditions under which these operations are performed, taking the necessary dust counts and checking existing ventilating facilities to insure that the hazard is being effectively and continuously controlled. In those instances where mechanical exhaust ventilation must be supplemented by the wearing of personal protective equipment, personnel exposed to such hazards should be furnished the Navy half mask, conforming to BuShips Ad Int. Specification, Masks (for Protection of Respiratory Organs from Toxic Fumes and Dust), dated 16 September 1946, 37M3, Type C, Class 1, Filter-Pad Masks.

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The following report from the Naval Shipyard, Portsmouth, New Hampshire, records the results of an investigation conducted at that activity:

"There were two investigations of occupational-health exposures during the month of October.

I (a) Conditions in the Asbestos Insulation and Pipe-Cover Section of Bldg. 174 were investigated and it was found that the dust count in this section was upward of 5 m./cu.ft.

(b) Recommendations were made as follows:

1. That the asbestos covering process be confined to as small a section of the shop as possible.
2. That proper ventilation be secured.
3. That appropriate respirators be worn by the workers.
4. That instruction be given workers in the use of respirators."

FLAMEPROOFING OF TEXTILES

THE National Bureau of Standards recently announced "Circular C-455, Flameproofing of Textiles," which sets forth most recent results of research to develop treatments which reduce the flammability of textiles and make them reasonably resistant to effects of water. It also gives a new method for determining the relative flammability of untreated textiles. Requests for this publication should be sent to the Safety Branch, Office of Industrial Relations, Building K-1005, Navy Department, Washington 25, D. C.

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Slip Opinion in the Matter of
Reaser v. Allis Chambers Corp., CV 08-1296-SVW (C.D. Cal. June 23, 2008)

EXHIBIT D

UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

ROBERT REASER, et al. Plaintiffs, v. ALLIS CHAMBERS CORPORATION, et al. Defendants.	CV 08-1296-SVW (SSx) ORDER DENYING PLAINTIFFS' MOTION FOR REMAND [18]

I. Statement of Facts

Plaintiffs Robert and Christine Reaser brought this action against General Electric Company ("GE"), Viad Corporation ("Viad")[1], and other Defendants in Los Angeles Superior Court on January 25, 2008. (Motion for Remand, at 1 ("Motion").) Plaintiffs allege that Robert Reaser ("Reaser") developed malignant mesothelioma as a result of exposure from Defendants' asbestos or asbestos-containing products aboard United States naval ships. (Complaint, at ¶ 3 ("Complaint").) Reaser served in the U.S. Navy from 1951 to 1964, during which he was allegedly exposed to asbestos while working on the *U.S.S Shea*, *U.S.S. Boston*, *U.S.S. Providence*, and the *U.S.S. Wilkinson*. (Defendant Viad Notice of Removal, at 3.) Plaintiffs allege that Defendants violated their state law duties to warn Reaser about the dangers of asbestos

[1] Defendants Viad and GE were the only defendants who removed the case and filed oppositions to the Motion for Remand.

exposure from equipment found on naval vessels. (Motion, at 1.) Viad, later joined by GE, removed the case to federal court based on the federal officer removal statute, which provides federal jurisdiction over claims against "any officer (or any person acting under that officer) of the United States or of any agency thereof . . . for any act under color of such office . . . ." 28 U.S.C. § 1442(a)(1). This statute does not require all Defendants to consent to removal. See Durham v. Lockheed Martin Corp., 445 F.3d 1247, 1253 (9th Cir. 2006) ("Whereas all defendants must consent to removal under section 1441 . . . a federal office or agency defendant can unilaterally remove a case under section 1442.")

Plaintiffs, clearly anticipating that one or more Defendants would attempt to remove the case to federal court, included a disclaimer in the Complaint which attempts to waive any cause of action arising from exposure to asbestos dust that occurred in a federal enclave, expressly excluding from the disclaimer U.S. Navy vessels. Plaintiffs also disclaim any cause of action resulting from exposure to asbestos dust caused by any acts or omissions of Defendants committed at the direction of a U.S. officer. (Complaint, at ¶ 4.) On April 14, 2008, Plaintiffs filed a motion for remand to state court on the ground that this Court lacks subject matter jurisdiction. (Motion, at 2.)

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II. Analysis

Three main issues must be addressed in examining Plaintiffs' Motion. The first is whether the standard of review includes a requirement that Defendants meet a "special burden" in showing that federal officer jurisdiction is proper. The second is whether Defendants meet the elements of federal officer jurisdiction. The third is whether Plaintiffs' disclaimer should be determinative as to the question of remand.

A. Standard of Review

A party seeking removal under § 1442(a)(1) must demonstrate that (a) it is a person within the meaning of the statute; (b) it can assert a "colorable federal defense"; and (c) there is a causal nexus between its actions, taken pursuant to a federal officer's directions, and the plaintiff's claims. Durham, 445 F.3d at 1251. Defendants Viad and GE assert that they must prove only by a preponderance of the evidence that removal to federal court is proper, as typically required. (See Defendant Viad Opposition Motion, at 3.)

Plaintiffs argue, however, that Defendants have a "special burden" in showing that federal officer jurisdiction is proper. (Motion, at 3.) Plaintiffs assert that the special burden requires Defendants to present concrete, verifiable evidence regarding satisfaction of federal officer jurisdiction, particularly with respect to satisfying the existence of a colorable federal defense. This burden would create a higher standard for Defendants at this stage of the litigation process. Citing to Williams v. General Electric Co., Plaintiffs allege that because § 1442(a)(1) is

"predicated on the protection of federal activity and an anachronistic mistrust of state courts' ability to protect and enforce federal interests and immunities from suit, private actors seeking to benefit from its provisions bear a special burden in establishing the official nature of their activities." (Motion, at 3) (quoting Williams v. General Electric Co., 418 F. Supp. 2d 610, 614 (M.D. PA. 2005)). Furthermore, Plaintiffs rely on Hilbert v. McDonnell Douglas Corp. in arguing for a heightened burden in satisfying the three prongs of § 1442(a)(1). 529 F. Supp. 2d 187 (D. Mass. 2008). In Hilbert, the defendants claimed that the military, through its contracts, exercised its discretion in such a way as to prevent them from warning the plaintiff about the dangers of asbestos, similar to the present assertions by Viad and GE. Id. at 199. The court required that the defendants submit actual citations to regulations or contracts evidencing the government's alleged control over asbestos warnings. Because the defendants did not produce such evidence, the court held that this "sort of speculation is not remotely adequate" to satisfy federal officer jurisdiction and remanded the case. Id. at 202-203.

The Ninth Circuit, however, has rejected the notion that defendants must meet a special burden in order to satisfy the three prongs of federal officer jurisdiction. In Durham, the Ninth Circuit noted that, while removal under § 1441 is to be strictly construed, the federal officer removal statute is to receive a generous interpretation. According to the Ninth Circuit, "the Supreme Court has held that the right of removal is absolute for conduct performed under color of federal office, and has insisted that the policy

favoring removal should not be frustrated by a narrow, grudging interpretation of § 1442(a)(1)." Durham, 445 F.3d at 1252 (citing Arizona v. Manypenny, 451 U.S. 232, 242 (1981)). Therefore, when federal officers and their agents are seeking a federal forum, the Court is to interpret § 1442 broadly in favor of removal. Id. In following the Supreme Court's broad interpretation of § 1442 and rejecting the need for a special burden, the Ninth Circuit has maintained that Defendants must simply make an adequate showing that the requirements of federal office jurisdiction are met to support removal to federal court. Id. at 1252-1253. Therefore, to qualify for removal, Defendants must be a person under the statute, raise a colorable federal defense, and present a basis for a causal connection between the charged conduct and the asserted government authority. Willingham v. Morgan, 395 U.S. 402, 409 (1969) (citing Maryland v. Soper (No. 1), 270 U.S. 9, 33 (1926)). Defendants need not prove their federal defense or a causal nexus to justify removal.

B. Three Prongs of Removal under § 1442(a)(1)

1. Person

As corporations, Defendants Viad and GE meet the preliminary requirement that the party seeking removal is a person within the meaning of § 1442(a)(1). See Fung v. Abex Corp., 816 F. Supp. 569, 572 (N.D. Cal. 1992). There is no dispute between the parties as to this prong.

2. Colorable Federal Defense

Defendants seek removal under the government or military contractor defense, which protects a government contractor from liability for acts done by him while complying with government specifications during execution of performance under a contract with the United States. McKay v. Rockwell Intern. Corp., 704 F.2d 444, 448 (9th Cir. 1983). The Supreme Court recognized the contractor defense in Boyle v. United Technologies Corp., where it held that liability for design defects in military equipment could not be imposed on a private government contractor under state law where: (1) the United States approved reasonably precise specifications; (2) the equipment conformed to those specifications; and (3) the supplier warned the United States about the dangers in the use of the equipment that were known to the supplier, but not to the United States. Boyle v. United Technologies Corp., 487 U.S. 500, 512 (1988). This defense has been extended to failure to warn cases; however, it is inapplicable in the absence of evidence that the defendants' decision to not provide a warning was "in compliance with reasonably precise specifications imposed on it by the United States." Butler v. Ingalls Shipbuilding, Inc., 89 F.3d 582, 586 (9th Cir. 1996). Where there is no conflict between requirements imposed under a federal contract and a state law duty to warn, the Court should defer to state law. Id.

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a. Reasonably Precise Specifications

To illustrate that reasonably precise specifications set forth by the Navy exist and that these specifications conflict with the state law duty to warn, Defendants rely on the declarations of Dr. Cushing and Admiral Lehman. Dr. Cushing, President of C.R. Cushing & co., Inc., Naval Architects, Marine Engineers and Transportation Consultants, notes that the U.S. government was intimately involved in the manufacture of any contractors' equipment used in U.S. vessels, "as the equipment manufactured for those vessels was designed and built to meet precise and exacting specifications of the U.S. Navy." (Cushing Dec., at 4.) Furthermore, Dr. Cushing asserts that "[w]hether certain equipment used aboard U.S. Naval vessels should have warnings, and the content and format of any such warning, was determined solely by the U.S. Navy." (Id. at 5.) Admiral Lehman, a retired Rear Admiral of the U.S. Navy, states that "equipment suppliers were prohibited from providing any warnings on or to accompany equipment supplied to the Navy without the consent and approval of the Navy." (Lehman Dec., at 5.) Moreover, Admiral Lehman claims that certain types of warnings were simply not approved by the Navy, such as any warnings associated with hazards from asbestos. (Id.) Plaintiffs argue that these declarations do not refer to actual contracts or any personal knowledge of contractual obligations owed by Defendants, but rather are mere speculations about what the Navy would have permitted. (Plaintiffs' Reply, at 6.) Essentially, Plaintiffs assert that Defendants have not adequately shown that the Navy set forth reasonably precise specifications, such that Defendants fail to raise a colorable federal defense.[2]

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[2] Plaintiffs further argue that Admiral Lehman and Dr. Cushing lack personal knowledge and that their declarations lack foundation and

Plaintiffs' argument relates to their assertion that Defendants must prove their case in order to satisfy the three prongs for removal under § 1442. (Motion, at 3.) Because the Supreme Court and the Ninth Circuit has declined to require that any such burden be placed on defendants in federal officer removal cases, the argument that actual contracts are required to illustrate reasonably precise specifications at this stage of the litigation process necessarily fails. See Willingham, 395 U.S. at 407 (noting that to be colorable, the defense does not need to be clearly sustainable, as the purpose of § 1442 is to secure that the validity of the defense will be tried in federal court). Defendants need not establish the validity of their federal defense in order to justify removal. Rather, they must only raise a colorable federal defense. The declarations made by Admiral Lehman and Dr. Cushing describe general naval policies and shipbuilding practices, and illustrate the lack of discretion given to government contractors in supplying equipment to naval vessels. As Plaintiffs point out, the declarations do not reference any specific contractual provisions that prohibit Defendants from placing warnings on naval equipment about the dangers of asbestos exposure.

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are speculative. These arguments lack merit because Admiral Lehman and Dr. Cushing's declarations are based on years of experience and training in regard to the design and operation of U.S. Navy vessels. Both declarants state that they are personally familiar with the degree of supervision and control of the Navy over the actions of its contractors. The declarations describe typical Navy specifications and offer explanations as to why warnings about asbestos would not have been permitted. (See Lehman Dec., at 2-3; Cushing Dec., at 2, 5.) Additionally, Plaintiffs claim the declarations are inadmissible per the "best evidence rule." Fed. R. Evid. 1002. This argument also lacks merit because Admiral Lehman and Dr. Cushing are not trying to "prove the content of a writing," but rather they are relying on their independent knowledge and familiarity regarding Navy specifications in making their assertions. Id.

The absence of specific prohibitions, however, does not render these declarations useless; rather, the declarations provide Defendants with a basis for asserting a colorable federal defense, which is all that is needed at the removal stage. A central district court similarly determined that Admiral Lehman's declaration created an inference that military contractors did not provide a warning concerning the dangers of asbestos because the Navy did not permit any such warning. Oberstar v. CBS Corp., No. CV 08-118 PA, at 5 (C.D. Cal. Feb. 11, 2008) (citing Nesbiet v. General Electric Co., 399 F. Supp. 2d 205, 208 (S.D.N.Y. 2005)). Once again, the court noted that defendants must only show a colorable federal defense at this stage of the litigation process, not one that will ultimately prevail. Id. Additionally, a Northern District of California court has specifically rejected the argument that a defendant must produce actual contractual documentation in order to demonstrate that it worked under reasonably precise specifications. See Ballenger v. Agco Corp., 2007 WL 1813821, at *3 (N.D. Cal. June 22, 2007) (stating that to require past contracts would frustrate the purpose of § 1442). In this action, based on the declarations of Admiral Lehman and Dr. Cushing, it is possible to find that the Navy set forth reasonably precise specifications regarding the use of warnings, such that Defendants have a basis for asserting a colorable federal defense.

b. Conformity to Reasonably Precise Specifications

As to the second element of the government contractor defense, Defendants must show that the products supplied to the U.S. Navy

conformed to the reasonably precise specifications set forth by the Navy. Essentially, Defendants must show that the Navy received what it sought. Based on the declarations by Admiral Lehman and Dr. Cushing, it can be inferred that any deviation from the Navy's specifications would have resulted in rejection of the equipment. (See Cushing Dec., at 4-5; Lehman Dec., at 4.) Thus, if Plaintiff Reaser had been exposed to asbestos on naval vessels where Defendants had supplied asbestos-containing equipment, it is likely that this equipment conformed to the detailed specifications set forth by the Navy. Had this equipment not complied with the Navy's specifications regarding design, installation, and warnings, it is a fair inference that the equipment would not have been placed on the ships. (Lehman Dec., at 4-5.)

c. Warnings by Defendants

Finally, the third element of the military contractor defense requires that Defendants did not fail to warn the Navy of any dangers associated with asbestos that were known by Defendants but not the government. As the Supreme Court in Boyle noted, "[t]he third condition is necessary because, in its absence, the displacement of state tort law would create some incentive for the manufacturer to withhold knowledge of risks, since conveying that knowledge might disrupt the contract but withholding it would produce no liability." Boyle, 487 U.S. at 512. Dr. Lawrence Betts, a retired Navy captain, states in his declaration that the Navy's knowledge regarding the dangers of asbestos and its health effects represented the state of the art. (Betts Dec., at 18.) Furthermore, he notes that "[d]uring

the period from the early 1920s to the late 1960s, there was nothing about the hazards associated with the use of asbestos-containing products . . . on United States Navy ships known by a manufacturer . . . that was not known by the United States and the United States Navy." (Id.) Based on this evidence, it seems possible to find that the information possessed by the Navy exceeded any information that could have been provided by Defendants, such that the third element is sufficiently satisfied for raising a defense. Therefore, it appears that Defendants have raised a colorable federal defense.

3. Causal Nexus

The final prong necessary to satisfy federal officer removal requires Defendants to demonstrate that the Navy controlled the warnings Defendants could place on its equipment and that this control prevented Defendants from fulfilling its alleged state law duty to warn of the dangers associated with asbestos exposure. Essentially, there must be a causal nexus between the claims against Defendants and the acts they performed under color of federal office. Ballenger, 2007 WL 1813821at *3-4. Similar to the second prong, Defendants must simply show the existence of a likely causal connection, not prove such a connection. See Jefferson County v. Acker, 527 U.S. 423, 432 (1999) ("Just as requiring a clearly sustainable defense rather than a colorable defense would defeat the purpose of the removal statute . . . so would demanding an airtight case on the merits in order to show the required causal connection.") Again, as shown above by the declarations of Lehman, Cushing, and Betts, the Navy had direct control over all aspects of the equipment

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supplied to its ships. It can therefore be inferred that the reason why Defendants did not place warnings on their equipment was because such warnings were precluded by the Navy's detailed specifications. (See Lehman Dec., at 4.) Plaintiffs allege that Defendants failed to warn of asbestos dangers, yet this alleged failure to warn, Defendants assert, resulted from the Navy's prohibitions and/or control over any such warning. Therefore, Defendants adequately show a causal nexus between Plaintiffs' claims and Defendants' actions.

Because Defendants have adequately asserted a colorable federal defense and a causal nexus between Plaintiffs' claims and Defendants' acts performed under the direction of the Navy, it appears that Defendants satisfy the three prongs of § 1442(a)(1).

C. Disclaimer

Plaintiffs additionally argue that removal is improper because of disclaimers appearing in the Complaint. Plaintiffs include two disclaimers in the Complaint. The first disclaimer does not operate to disclaim any cause of action subject to federal officer removal. (Complaint, at ¶ 4.) The second disclaimer, however, specifically disclaims "any cause of action or recovery for any injuries resulting from exposure to asbestos dust caused by any acts or omissions of a party Defendant committed at the direction of an officer of the United States Government." (Id.) However, because removal pursuant to the federal officer removal statute is premised on the existence of a colorable federal defense, rather than the manner in which a plaintiff's complaint is constructed, courts have found that neither a plaintiff's disclaimer nor its characterization of his claims is

determinative. See Oberstar, No. CV 08-118 PA at 3. See also Durham, 445 F.3d at 1253 ("[R]emovals under section 1441 are subject to the well-pleaded complaint rule, while those under section 1442 are not."); Ballenger, 2007 WL 1813821 at *2 ("Under the federal office removal statute, suits against federal officers may be removed despite the nonfederal cast of the complaint.") The Court takes a similar view. Plaintiffs' second disclaimer effectively mirrors Defendants' federal contractor defense and so in no way prevents litigation of the applicability of that defense in state court, which is precisely what the federal officer removal statute seeks to avoid. To grant a plaintiff's motion for remand based on such a disclaimer would, therefore, render the federal officer removal statute completely ineffectual in the face of an "artfully constructed" complaint. Oberstar, No. CV 08-118 at 3. The Court cannot allow Plaintiffs to evade federal officer removal in such a fashion.

Plaintiffs rely on Westbrook v. Asbestos Defendants, where the court, when faced with similar facts and evidence, found the plaintiffs' disclaimer to be determinative and remanded the case back to state court. 2001 WL 902642 at *3 (N.D. Cal. July 31, 2001). However, Westbrook is distinguishable from the present case in that the plaintiffs in Westbrook disclaimed "any claims arising out of work done on United States Navy ships." Id. at *2. In other words, the plaintiffs in Westbrook specifically waived any causes of action stemming from asbestos exposure on naval vessels; instead premising their claims on injuries arising from work done on private ships. Id. As a result, unlike in the present case, the parties in Westbrook had no need to litigate any issue resembling the federal

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contractor defense in order to determine the applicability of the plaintiffs' disclaimer. Therefore, remand in that case did not undermine the purposes of § 1442(a)(1), as remand here would, and so was appropriate.

III. Conclusion

Based on the foregoing reasons, Plaintiffs Robert and Christine Reaser's Motion for Remand is DENIED.

IT SO ORDERED.

DATED: June 23, 2008

STEPHEN V. WILSON
UNITED STATES DISTRICT JUDGE

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Attorneys for Defendant Viad Corp. f/k/a
The Dial Corporation

IN THE THIRD JUDICIAL DISTRICT COURT IN AND FOR

SALT LAKE COUNTY, STATE OF UTAH

HOWARD WADE AND DEANNA LYNN WADE, Plaintiffs, v. INDUSTRIAL SUPPLY COMPANY, INC. et al., Defendants.	**NOTICE OF NOTICE OF REMOVAL FILED BY DEFENDANT VIAD CORP.** Case No. 210907011 Judge Randall Skanchy

PLEASE NOTE: Defendant Viad Corp. *f/k/a* The Dial Corporation ("Viad") sued erroneously herein as successor-in-interest to Griscom Russell Co. ("Griscom-Russell") filed the attached Notice of Removal with the United States District Court for the District of Utah, Central Division on February 14, 2022 pursuant to 28 U.S.C. § 1442.

DATED 14th day of February, 2022.

Respectfully submitted,

CHRISTENSEN & JENSEN, P.C.

/s/ Rebecca L. Hill
Rebecca L. Hill

CERTIFICATE OF SERVICE

The undersigned does certify that on February 14, 2022, the foregoing *Defendant Viad Corp.'s Notice of Removal* was electronically filed, as required by the United States District Court for the District of Utah, using the Court's CM/ECF filing system, which will provide notice and a copy of this document to the following as a e-filer:

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/s/ Rebecca L. Hill
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